Power Engineering

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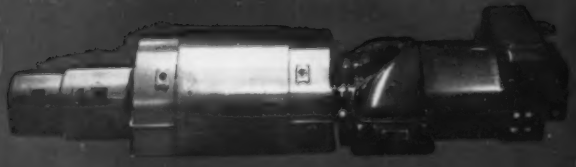
ELLIOTT
equipment for power and process

Deaerating Heaters

Condensers

Generators for Diesels



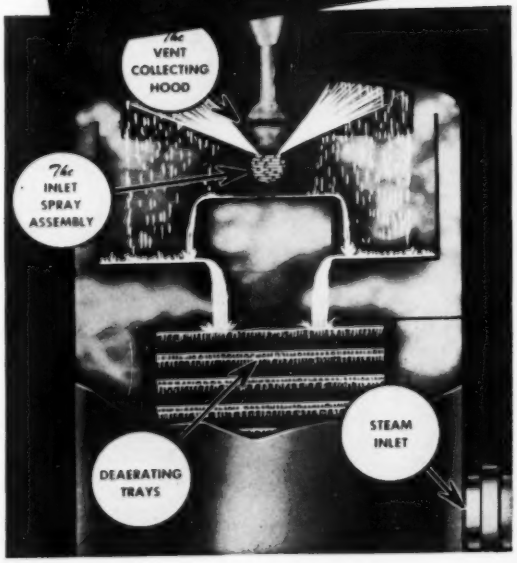
Turbine Generators

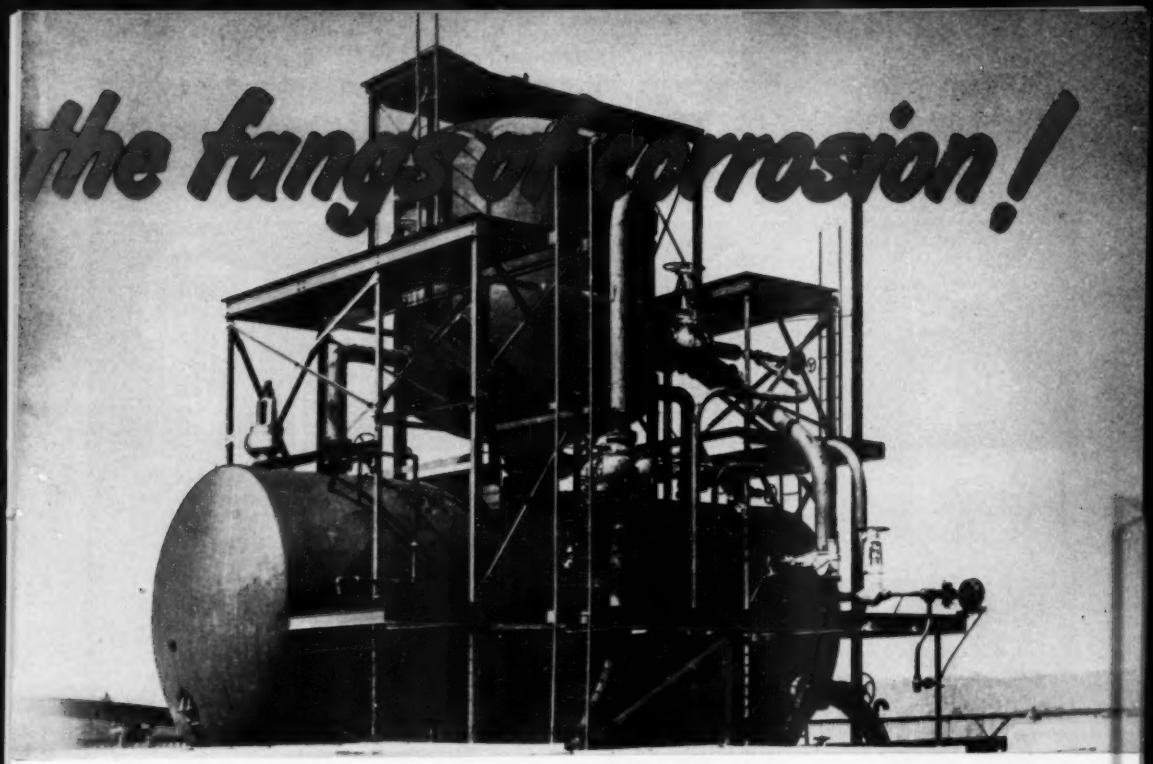
Large Motors

Centrifugal Blowers

They draw

ELLIOTT DEAERATING HEATERS





Skyline views of most modern power plants

may show the Elliott deaerating heater mounted on its storage tank, as in the southern station pictured above. It is a symbol of liberty from the corrosive oxygen which it removes from boiler feedwater — a freedom which dates from the initial development of the deaeration principle by Elliott engineers.

This is the inlet spray unit and vent collecting hood, mounted inside the shell at the top. (See section drawing at left.)

The design of the Elliott deaerating heater of today virtually eliminates maintenance. The tubular vent condenser formerly used is replaced with an inlet spray unit and vent collecting hood that require no attention, and also cut down the unit's vertical dimension, important in limited headroom. Trays are of light stainless steel. Wherever undeaerated water contacts the metal, non-corrodible material is used.

The complete deaerating heater is built throughout in the Elliott shops. Full details are given in Bulletin N-16, mailed on request.

ELLIOTT Company

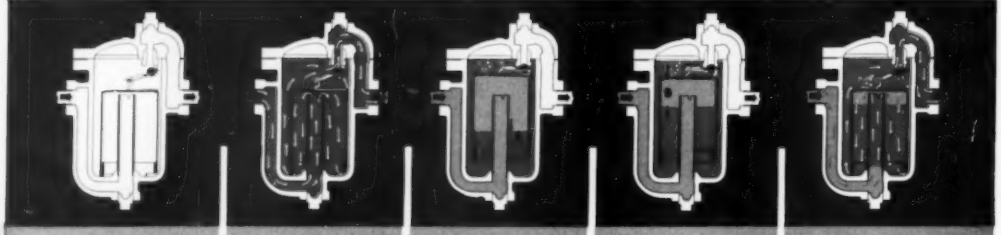
Deaerator and Heater Dept. • JEANNETTE, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA. • AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.

DISTRICT OFFICES IN PRINCIPAL CITIES

Q2-2

ARMSTRONG TRAPS are Designed to give Outstanding Performance



1. When trap is installed, inverted bucket is down and valve is wide open.

Side inlet —side outlet body style

Bottom inlet —top outlet body style

2. When steam is turned on, condensate (solid color) flows into trap and out orifice, until . . .

SELF-SCRUBBING ACTION (See Fig. 2 above). Note that condensate first flows down between bottom of bucket and trap body, then up and out through orifice. The high velocity flow under bottom of bucket keeps dirt in suspension, washes it out when trap opens. No dirt problems with Armstrong design.

3. . . . steam (light color) reaching the trap floats the inverted bucket and closes the valve.

BUCKET FLOATS WHEN LESS THAN ½ FULL OF STEAM (See Fig. 3 above). The generous margin of safety (dimension A in Fig. 3 above) insures that the bucket will float with trap body partly full of water. A heavier bucket would give more power but it might float and close the valve.

4. When more condensate enters, bucket loses buoyancy and pulls on valve lever.

NO AIR BINDING (See Fig. 4 above). Air mixed with steam passes through the bucket vent, collects at top of trap and is discharged ahead of condensate. The large air-handling capacity of Armstrong traps insures top equipment temperatures and faster heat-up.

5. When weight of bucket times leverage overcomes pressure on valve, trap opens.

EXCESS POWER FOR OPENING (See Fig. 5 above). Armstrong design provides a generous safety margin. Reducing dimension B in Fig. 4 would increase power of bucket but margin between test opening pressure and operating pressure would be too low to allow for normal wear and pressure fluctuations.

THE highly efficient design of modern Armstrong traps reflects over 40 years' experience in inverted bucket trap manufacture and application.

ARMSTRONG design offers:

- A "frictionless" leverage system which combines high leverage with wide opening of a large orifice.
- A minimum of parts.
- Strong, corrosion-resistant and wear-resistant materials.
- Generous margins of safety.

FOR TRAP USERS this means:

- Large capacity.
- Dependable service under adverse operating conditions.
- Low maintenance.
- Continuous operation of heating and process equipment.

The soundness of Armstrong design has been proved in thousands of plants all over the world. To insure dependable condensate drainage simply specify: "Traps shall be Armstrong." For additional information, call your local Armstrong Representative or write:

ARMSTRONG MACHINE WORKS
810 Maple Street, Three Rivers, Michigan

● ***SEND FOR*** **NEW 44-PAGE STEAM TRAP BOOK.** Complete data on Armstrong trap design and operation; physical data and list prices; capacities; selection, installation and maintenance recommendations. **Free on request.**

Cross-section Armstrong inverted bucket bottom inlet—top outlet trap.

ARMSTRONG STEAM TRAPS

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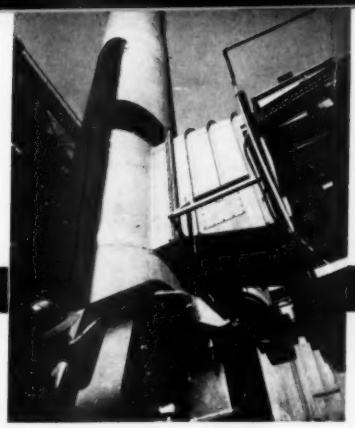
AUGUST 1952
VOL 56 NO. 8



Splash-proof 400-hp motor drives outdoor draft fans at Texas oil refinery power plant

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Subscription Information — Published Monthly. Price: United States and Possessions $10, Canada $11, one year. Other countries $12.....Single copies $1.00.

NBP *Indexed in the Industrial Arts Index and the Engineering Index on file in Public Libraries*

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NEW BOILER WATER CONDITIONING PACKAGE

Adjust-O-Feeder
Model X 52

- LOW COST
- COMPACT
  Built-in standard motor — no separate gearbox or couplings.
  Built-in oil-enclosed gear reducer.
- MICRO-STROKE ADJUSTMENT
  Scale easily read — crank and connecting rod operate in horizontal plane.
- LONG LIFE AND EASY MAINTENANCE
  One-piece Meehanite iron frame for positive alignment of all moving parts.
  Double check valves on suction and discharge easily removable.

This new, compact chemical feed pump, by %Proportioneers, Inc.%, is inexpensive and provides accurate boiler water treatment for plants where a low capacity, medium pressure pump will meet requirements. The standard Model X 52 has a capacity range from 1 to 10 GPH and will discharge against pressures up to 650 psig. For lower feeds, the unit is available with a range of from 0.5 to 5 GPH. Complete and self-contained, Model X 52 weighs less than 100 lbs. and is ready to operate as soon as piping and motor are connected.

Ask for Bulletin 1105

%PROPORTIONEERS, INC.%

Write to %PROPORTIONEERS, INC.%, 385 Harris Ave., Providence 1, R. I.

Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.

ENGINEERS' PREVIEW

More than 10,000 engineers will go to Cleveland during September 8-12, 1952 for the Seventh National Instrument Conference and Exhibit sponsored by the Instrument Society of America. This will be the largest conference and exhibit, covering instruments and devices for measurement, inspection, testing, and automatic control, ever held in the United States.

A technical program consisting of some 39 technical sessions has been arranged for the ISA and other organizations cooperating in the Conference. The Industrial Instruments and Regulators Division of the ASME is conducting a special symposium on High Pressure Instruments. Others cooperating are the American Institute of Physics; the American Institute of Electrical Engineers; the Cleveland Physics Society; the Institute of Radio Engineers, Cleveland Section; and the Scientific Apparatus Makers Association.

★ ★ ★

I. Melville Stein, executive vice president of Leeds and Northrup Co., Philadelphia, will henceforth be a Fellow of the ASME. D. Robert Yarnall, past president of the society, presented the certificate of award to Stein March 25 at the monthly meeting of the Philadelphia chapter. Once an associate of the late Thomas A. Edison, Stein has been connected with Leeds and Northrup for 33 years.

★ ★ ★

Thomas A. Edison, Inc., will have a new half-million dollar Edison laboratory at West Orange, N. J. Charles Edison, chairman of the board and son of the founder, broke ground for it recently. The site is near the original brick structures built by Thomas A. Edison in 1887, which are generally recognized as the first industrial research laboratory, now headquarters for the Thomas Alva Edison Foundation.

The laboratory will be devoted to basic research and technical work directly supporting the operations of the Company's seven manufacturing divisions.

★ ★ ★

Commonwealth Edison Company in Chicago will construct a major substation for its system, to be known as the Jefferson Substation, which will be one of the largest installations of its kind in the country. It will occupy nearly two city blocks and will have an initial capacity of 200,000 kw with an eventual capacity of 800,000 kw. Incoming voltage from their Ridgeland station will be 138 kv and will be reduced to 69 kv for redistribution.

Part of the substation equipment will be enclosed but much of it will consist of outdoor banks of transformers and switching apparatus.

The site was acquired by the company as part of a long range expansion program. Generating capacity of the Commonwealth Edison system now exceeds 3,000,000 kw and will reach a total of 3,722,000 kw with the additional units scheduled for completion in the next three years.

★ ★ ★

You will probably be plagued by delays in delivery of wire and cable that you need urgently, unless you give the manufacturers of this material some cooperation. These manufacturers are in turn plagued by shortages of reels and spools for their products.

Big reels or small, wire and cable makers need any reels you've got on hand to help meet a severe shortage. Take another look at your back lot and return all empties like this to the manufacturer

The drum-type reels are of rolled steel and are very difficult to obtain. The flanges generally are made of spruce, and the lumber must be seasoned, otherwise the joints will open up. The older, more seasoned reels and spools, which may be stranded on your back lot, are more dependable therefore, and should be put to work. If you will get them back into the hands of your wire and cable suppliers, you'll doubtless notice a difference in deliveries on new orders.

★ ★ ★

The 1951 Bituminous Coal Annual, fourth edition, will be the largest edition ever published by the Bituminous Coal Institute, Southern Bldg., Washington 5, D. C. This 6 by 9 in., paper bound, 204 page book is well illustrated with 90 colorful charts and many new photographs to accompany up-to-date text material about the soft-coal industry. Containing authentic, informative and interesting facts and figures, the book takes a detailed look at bituminous coal's role in modern American living as well as more than a backward glance as to how it got that way.

Somewhat more than a dry compilation of cold fact, close inspection is given to many phases of the industry including chapters dealing with energy, resources, production, transportation, markets, labor, safety, research and finance.

To the engineer, with at least a modicum of need, the Annual is a source of readily understandable statistics in addition to being a fund of interesting, if not strictly useful, general information on the soft-coal industry.

Text of the Annual without illustrations and tabulations has also been published by the Institute as a separate booklet, Powering America's Progress. Single copies of both may be obtained from the Institute free of charge.

★ ★ ★

H. K. Ferguson Company, industrial engineers and builders with offices in New York and Cleveland, will engineer a process development plant for the Nickel Process Co. at the U. S. Government-owned Nicaro Nickel Plant in Nicaro, Cuba. This pilot plant, which is part of the Nickel Processing Co.'s program for production of additional tonnages of nickel, and the recovery of by-product cobalt, will be operated by them under a management contract.

★ ★ ★

Commercial Testing & Engineering Co., formerly located at 307 N. Michigan Ave., Chicago, together with Carroll, Bechtel and Langtry, Division of Commercial Testing & Engineering Co., will henceforth have new quarters. They are moving into the Builders Building, Suite 2020, 228 N. LaSalle Street, Chicago 1, Illinois. Their telephone number remains the same.

★ ★ ★

The Stephan Co., 7016 Euclid Avenue, Cleveland, Ohio, will represent Detroit Stoker Co. in the Cleveland territory.

★ ★ ★

Northern Equipment Division, Erie, Penna. and Vulcan Soot Blower Division, DuBois, Penna. will be merged into Copes-Vulcan Division, Continental Foundry & Machine Company with factory and general offices at 939 West 26th Street, Erie 4, Penna. More details later.

★ ★ ★

L. C. Campbell will be the new president of the National Coal Association. The Board of Directors of the National Coal Association at its meeting in Washington, June 17, elected Mr. Campbell of Pittsburgh, Penna. as President of the Association, and Tom Pickett, presently a

member of Congress from Texas, to the post of Executive Vice President.

Mr. Campbell, who has been a member of the National's Board of Directors and the Executive Committee for many years, is Vice President of the Coal Division of the Eastern Gas and Fuel Associates and in charge of their extensive mining operations in West Virginia, Pennsylvania, and Kentucky.

★ ★ ★

E. S. PETTYJOHN as vice president of the Institute of Gas Technology which is an affiliation of the Illinois Institute of Technology, Chicago, will be the first one in its history. He was given this position in recognition of his contribution, as director, to the Institute's rise to its present position in the fields of research and education.

Elmore Shaw Pettyjohn, new vice president, Institute of Gas Technology, Illinois Institute of Technology

Mr. Pettyjohn brings to the Institute a wide and varied experience in gas production, in teaching, in Gas Industry research, and in sales and administration. He is the author of numerous articles on various phases of the Gas Industry, the result of his participation in research for many years.

★ ★ ★

RUSSELL T. BRANCH, president of Stone & Webster Engineering Corp., will now be Dr. Branch. An honorary degree of Doctor of Engineering was conferred on him by Stevens Institute of Technology, on June 8, 1952, the 40th anniversary of his graduation from that institution.

In presenting Mr. Branch for the degree, Dr. Jess Harrison Davis, President of the Institute, read from the citation, in part, as follows:

"Master constructor, noted engineer, eminent executive, successful son of Stevens. . . . His particular field of engineering has been construction; and while he has had responsible charge of many large projects of various types, including steam power stations, refineries, and manufacturing plants, perhaps his most important work was the electromagnetic plant and related works of the War Department atomic bomb plant at Oak Ridge, Tennessee. . . . He typifies the engineer who has distinguished himself through the combined use of his technical and administrative abilities."

★ ★ ★

L. B. FRANKLIN, for the past 14 years District Manager for Southern Coal Company, Inc. at Louisville, Kentucky, will henceforth be a vice-president of the company and member of the Board of Directors. Mr. Franklin will make his headquarters at Southern's St. Louis office.

★ ★ ★

DON'T BE SURPRISED if the much-maligned comic books, or perhaps more accurately, cartoon books, may soon prove very useful in teaching your small son a number of things about power engineering, atomic power, safety and other matters in which you are yourself interested. For a good many years, the whole educational field, as well as various religious and sociological bodies, have been concerned about the comic book situation. If such a technique was so powerful, reasoned a good many people, that did not mean that the technique itself was bad. It meant that some care should be exercised to use the comic book method for exerting good influences on the young mind, and a great deal of progress has been made in that respect in the comic book field in recent years.

The latest development we have seen, however, is even more significant. Here, for example, is a cartoon booklet entitled Adventures Inside the Atom, produced by General Electric Co. and giving in pictorial form some of the fundamental concepts of nuclear energy. Among other things it ends with a little warning to the young reader to go slow about swallowing all the stuff about atomic rockets to the moon, atomic disintegrator guns, atomic pills to run our autos for years. "Hold on, Johnny!" says one character, "you've been reading too many comics!"

Here's another cartoon booklet entitled Captain Marvel and the Lieutenants of Safety, teaching some very good lessons in safety by the cartoon technique. Another one entitled Johnson Makes the Team, put out by the B. F. Goodrich Company, interprets the benefits of competitive enterprise.

These new types of comic books are the modern version of the *dime novels* of this writer's boyhood, which were deprecated as a bad influence by all the narrow-minded people who never read a word of them. But they showed how Frank Merriwell and other good characters overcame evil and helped their fellow men; they always allowed initiative, resourcefulness and ability to triumph; and even though no one ever hit the target of idealism that they set up, they at least furnished the target. We hope to see more of the present day comic books do the same.

★ ★ ★

IVAN L. BATEMAN, veteran Department of Water and Power employee, will be assistant chief electrical engineer of Los Angeles Department of Water and Power. His appointment is as of May 1.

Ivan L. Bateman, assistant chief electrical engineer of the Los Angeles Department of Water and Power

Since 1939, Bateman had been head of the Power System operating and maintenance division, with over 3000 employees under his supervision.

In his new position, he will be responsible for the operation and coordination of the Operating and the General Plant Divisions, and will report directly to William S. Peterson, chief electrical engineer.

★ ★ ★

HAGAN CORPORATION, combustion and chemical engineering firm, will establish its new Aeronautical and Special Products Division "to meet a growing demand for high performance regulating and measuring devices" in aeronautical engine testing, gas turbine controls, blower controls, thrust and torque measurement, and similar problems.

Initial work of the new division will be the development of controls in the fields of aeronautical engine and guided missile testing, wind tunnels, atomic power plants, industrial gas turbines, centrifugal blowers, force measuring systems, and other applications involving special metering problems in air flow and fuel flow.

Named manager of the Aeronautical and Special Products Division is William F. Waina, a member of the Hagan sales staff since 1940.

★ ★ ★

ROBERT W. SUMAN will be chief engineer for the new Colmar, Penna., plant of Link-Belt Co. and Norman Virkler will succeed Mr. Suman as chief engineer for the Philadelphia plant.

RESEARCH AND USE PROVED QUALITY OF SUN ELECTRICAL OILS

Constant research has enabled Sun to keep pace with the ever-changing requirements of the fast-moving electrical industry. Used for years by leading manufacturers of cables, capacitors and transformers, Sun Electrical Oils have been "Job Proved" under actual operating conditions. This combination of laboratory research and field experience assures you of completely dependable products that satisfy the most rigid electrical requirements.

SUN CABLE AND CAPACITOR OILS...

1. LOW POWER FACTOR—assures minimum current loss because of high insulating value of oil.

2. HIGH DIELECTRIC STRENGTH—due to freedom from solid impurities and moisture.

3. HIGH RESISTANCE TO OXIDATION—due to choice of crude stocks and method of refining, Sun Electrical Oils have high stability, and as a result, oxidation is minimized.

4. LOW POUR POINT—an inherent quality that assures fluidity under most operating conditions.

5. FREEDOM FROM CORROSIVE ACIDS AND CORROSIVE SULFUR—helps prevent deterioration of cable materials.

SUN TRANSFORMER OILS...

1. EXCEPTIONAL HEAT TRANSFER ABILITY—eliminates heat build-up.

2. HIGH DIELECTRIC STRENGTH—due to complete freedom from solid and liquid impurities.

3. FREEDOM FROM CORROSIVE ACIDS AND CORROSIVE SULFUR—helps prevent deterioration of transformer components.

4. HIGH RESISTANCE TO OXIDATION—because Sun Electrical Oils, as produced, are free of impurities and possess high degree of stability, oxidation is minimized throughout their life.

5. INHERENT LOW POUR POINT—assures fluidity under most operating conditions.

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SUN OIL COMPANY, Dept. PO-8 Philadelphia 3, Pa.

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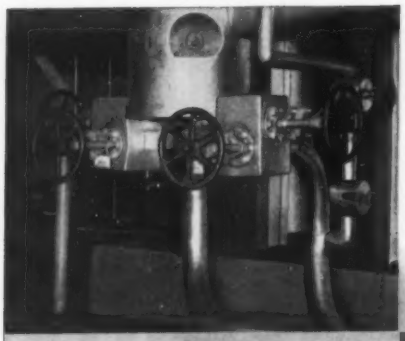
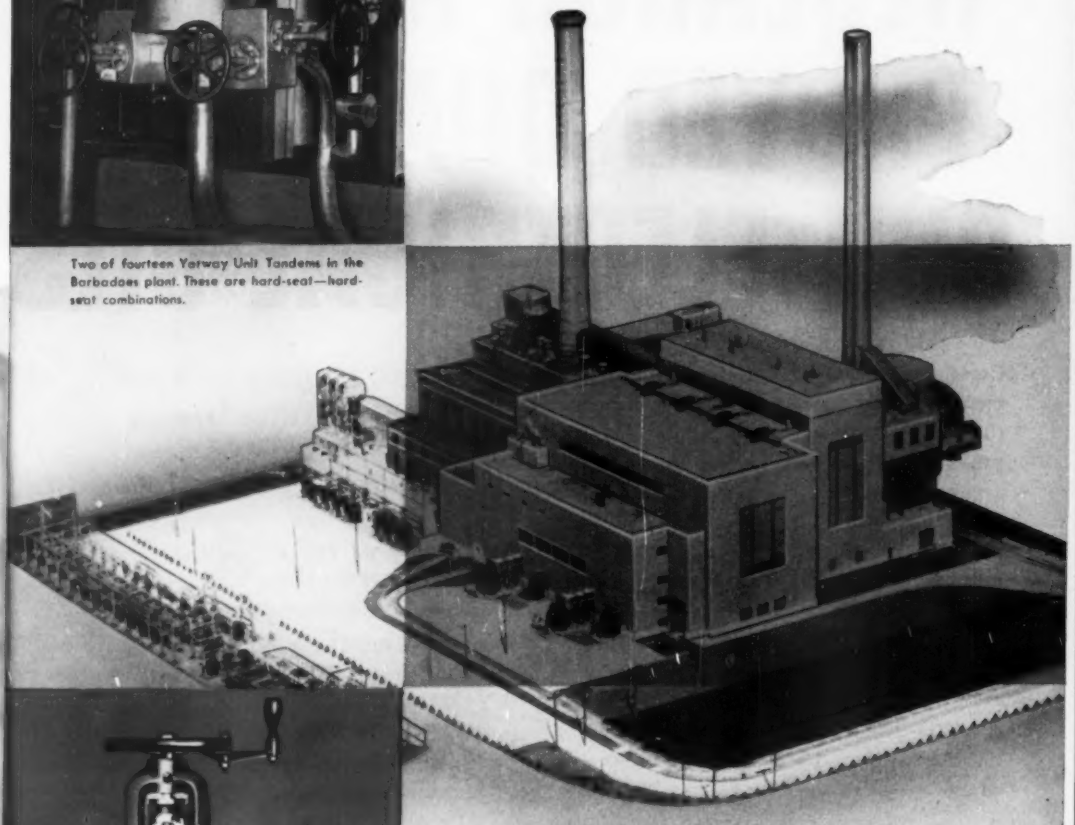
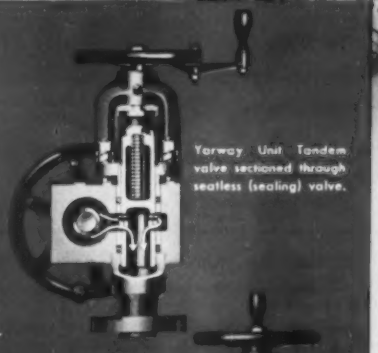


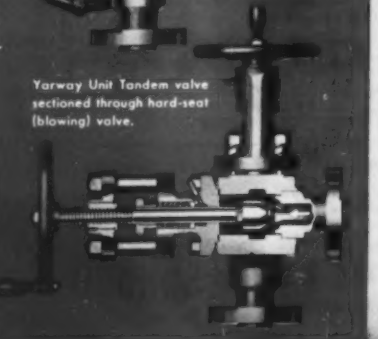
Two of fourteen Yarway Unit Tandems in the Barbadoes plant. These are hard-seat—hard-seat combinations.

BARBADOES BOILERS GET





Yarway Unit Tandem valve sectioned through seatless (sealing) valve.



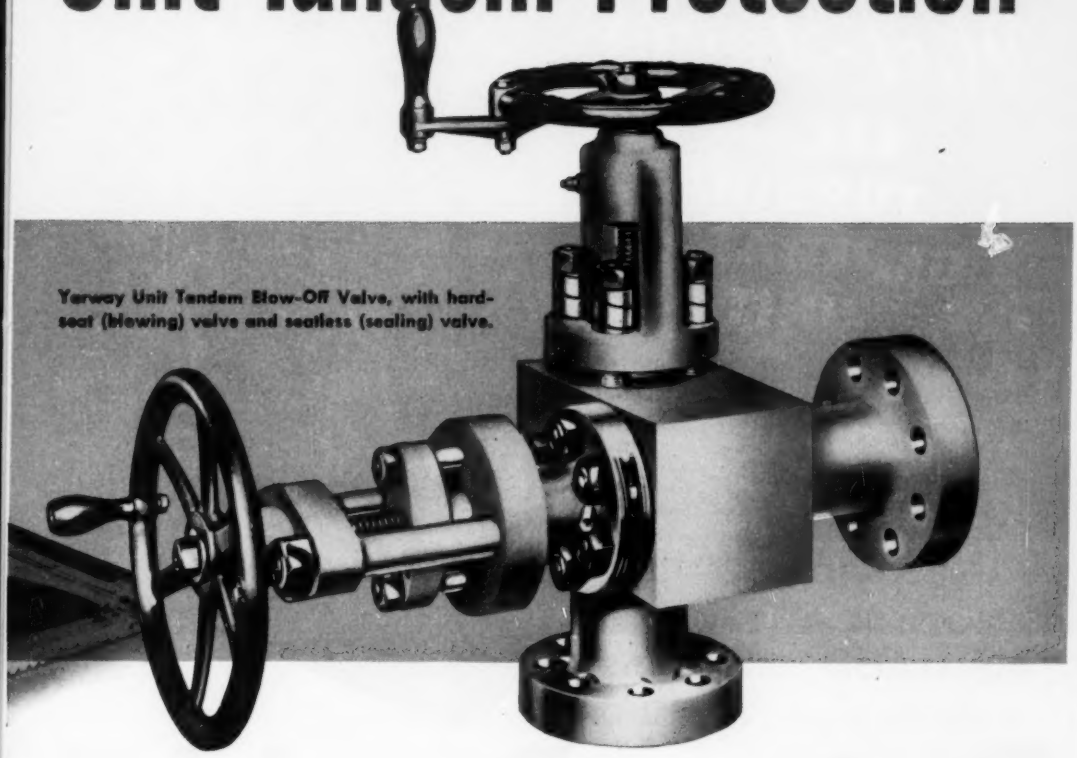
Yarway Unit Tandem valve sectioned through hard-seat (blowing) valve.

■ When a company has a $25,000,000.00 stake in the future such as Philadelphia Electric Company does in its Barbadoes Station —then protects the boilers of that plant with Yarway Unit Tandem Blow-Off Valves—it's significant of the dependability of those valves.

Barbadoes is a fine example of modern power plant engineering, demonstrated by the fact that only 11 men per shift are needed for operating this 180,000 KW station.

YARWAY

Unit Tandem Protection



Yarway Unit Tandem Blow-Off Valve, with hard-seat (blowing) valve and seatless (sealing) valve.

Yarway Unit Tandem Blow-Off Valves also are a good example of steam equipment engineering—used in more than 4 out of 5 high pressure boiler plants in the country.

Rugged construction makes Yarways strong and tough enough to withstand severest blow-down conditions. Metallurgical improvements make them resistant to the reactions of periodic acid wash. *Outages are rare where Yarway boiler valves are used.*

Unit tandems are available in various combinations to meet all pressure and service requirements.

Write for Bulletin B-433 for full details on Yarway Unit Tandems. For lower pressure blow-off valves, write for Bulletin B-424.

YARNALL-WARING COMPANY
114 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

STEAM PLANT EQUIPMENT

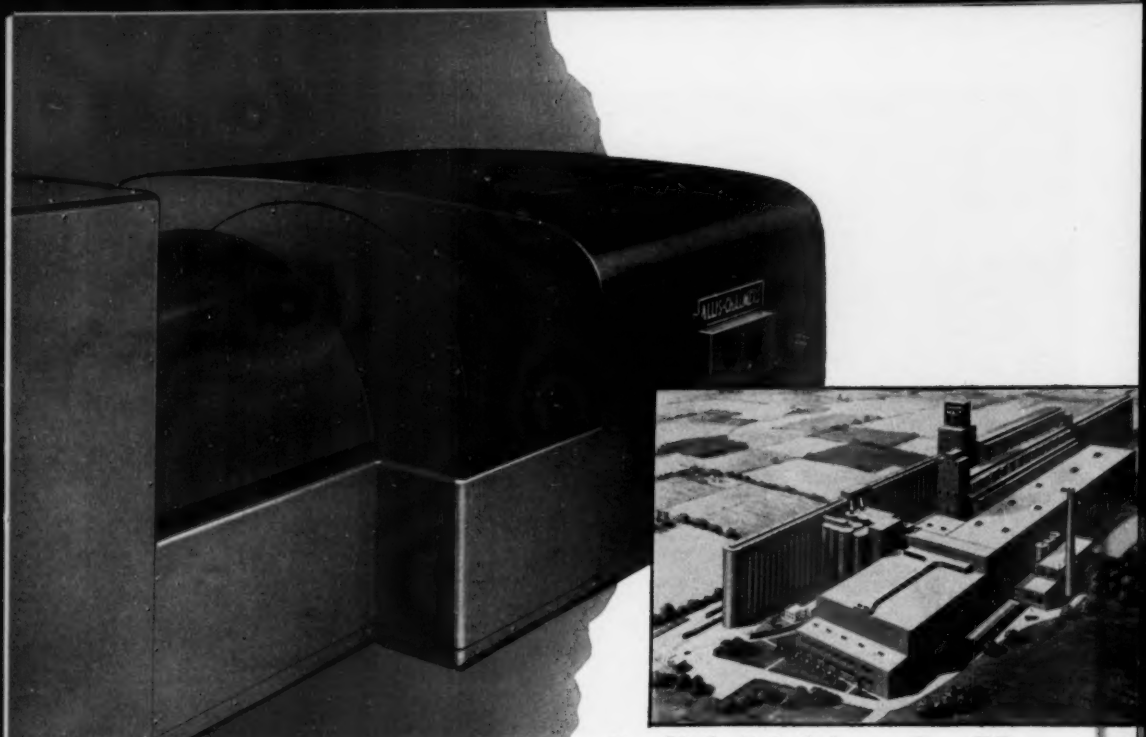
WA-Series

STEAM TURBINE GENERATOR UNIT

Doing Double

AT ONE OF WORLD'S LARGEST MALT

SIMPLIFYING INSTALLATION, both turbine and generator (shown at left) are shipped as complete assemblies with the rotors locked in place. The WA-Series generator is of the housing type with air-coolers mounted in the stator above the floor lines, eliminating special coolers and duct work.



Ladish Malting Co. Uses Steam for both Processing and Power Generation

Duty

HOUSES!

GREAT QUANTITIES OF STEAM are required in the process of manufacturing 10 million bushels of malt annually at the Ladish Malting Co., Jefferson Junction, Wisconsin. And, as an economic by-product, the electric power needed for plant operation is generated by the same steam.

When this world's largest single unit malt house recently needed more generating capacity, Allis-Chalmers again was chosen. And with good reason, since two Allis-Chalmers units had been supplying the electric power consumed at the Ladish Malting Company for nearly fifteen years.

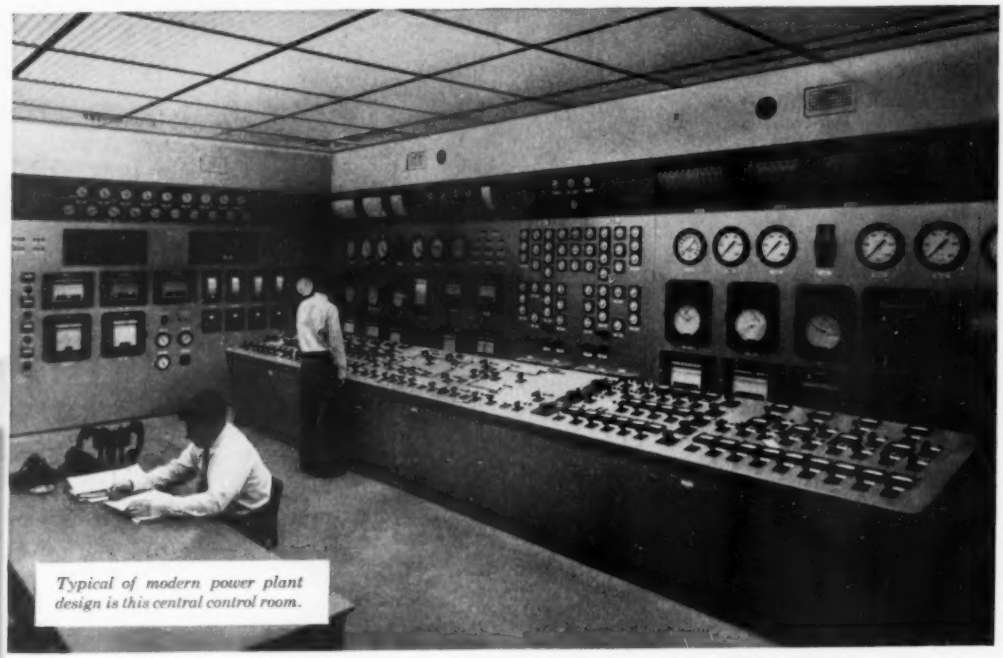
Installed in 1951, the modern 2500 kw WA-Series unit shown here is now on 24 hr a day, 7 day a week duty. It consists of a non-condensing impulse steam turbine and housing type air-cooled generator and exciter . . . carefully engineered and manufactured to operate as an integrated unit.

Built for condensing or non-condensing service in NEMA ratings through 7500 kw, a modern WA-Series unit also will enable *your* power plant to meet tomorrow's expanded power demand. Complete details contained in new Bulletin 03B7654. For your copy, just call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wis.

A-3601

ALLIS-CHALMERS

A-C ALLIS-CHALMERS



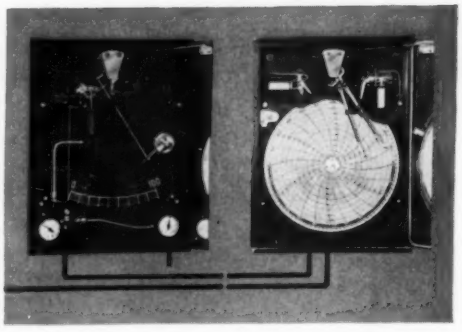
Typical of modern power plant design is this central control room.

For centralized

look to Honeywell for pressure, level and

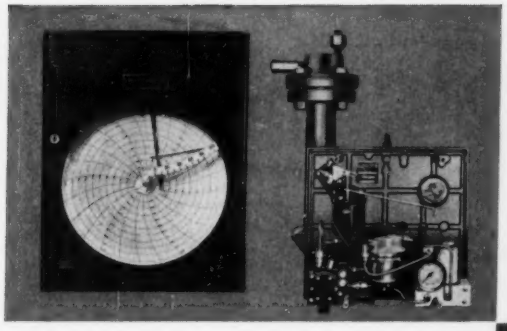
remote pressure measurement

By using Brown transmission systems, pressure measurements can be recorded in the operating control board without any high pressure piping going to the control panel . . . thus simplifying supervisory panel construction, reducing panel cost and improving safety to operators. Connections to the panelboard carry only low pressure instrument air. Brown sensing elements cover a variety of ranges from superheat and oil pressures to condenser vacuum.



Prompt Service . . . from Coast to Coast

Wherever you may be, you'll find one of the more than 80 Honeywell offices convenient to you . . . ready to give quick, on-the-spot service. You can get a factory-trained service engineer when you need him . . . often in a matter of hours . . . just by calling the Honeywell office nearest you.

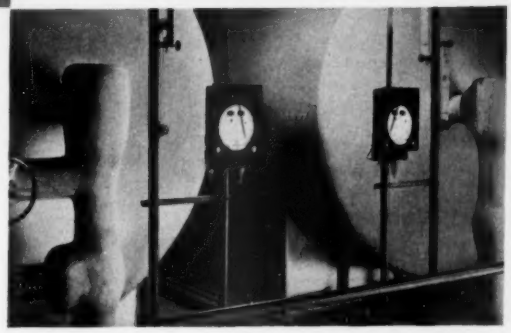


remote flow measurement

Flow of boiler steam, auxiliary steam, feedwater and other critical parts of the heat cycle is readily measured and transmitted to the control room by Brown instruments. Systems can be either the square root type (electric or pneumatic transmission) or evenly graduated type (electric transmission) . . . the latter ideally suited to flow cost accounting. Its evenly graduated scale permits full readability at all flow rates . . . eliminates inconvenience of crowded divisions at low range. Electronic integration is fast and precise; features simplified, maintenance-cutting design.

remote liquid level measurement

Brown pneumatic-transmitting instruments keep operators informed of the level of liquid in condensate storage tanks, hot wells, boiler drums and other locations remote from the control room. Measuring systems are supplied for open tanks, for closed vessels which operate under pressure, for corrosive liquids, and liquids containing suspended solids.



instrumentation . . .

flow measurement (and transmission)

EFFECTIVE utilization of centralized supervisory instrumentation for power plants places a premium on the accuracy and dependability of remote measurements and transmissions.

You can count on Brown flow, pressure and liquid level instruments to deliver the performance you need. Using pneumatic transmission, they accurately relay information from the metering point to receiving instruments in operating areas and in central control room . . . operating at full responsiveness over distances of several hundred feet.

At the transmitting end, an appropriate sensing element detects the measured variable, and a pneumatic transmitter produces a low pressure output varying in proportion. A small diameter air line conveys this pressure to remote recording instruments on the central control board and indicators on the local control boards.

Matched construction and characteristics of the transmitter and receiver assure top accuracy. Rugged design keeps calibration constant at both ends of the system.

Widely used in hundreds of industrial plants, Brown pneumatic transmission systems are available in every range needed for power plants. Electric transmission systems, for these same variables, can also be supplied when preferred. Your local Honeywell engineer will be glad to discuss your specific applications. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4587 Wayne Ave., Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

First in Controls

● *Important Reference Data*

Write for Catalog 90-2, "Supervisory Instruments for Power Generation" and Instrument Data Sheet No. 9.1-4, "Pneumatic Transmission Improves Safety."

Industries served by VU Boilers

Aircraft
Asphalt
Automobile
Breweries
Building Materials
Carpet
Cellophane
Cement
Chemical
Coal Mining
Coke
Cold Storage
Dairy
Department Stores
Distilling
Explosives
Electrical Equipment
Electric Power
Food Products
Foundries
Gas Works
Gelatine
Glass
Hosiery
Knitting Mills
Institutions
Laundries
Leather
Linoleum
Locomotive
Lumber
Machinery
Metal Producing
Mining
Municipal
Oil Refining
Paint
Paper
Public Utilities
Radio
Railways
Refrigeration
Rubber
Schools
Sewage Plants
Shipbuilding
Sugar
Textile
Tobacco
U. S. Government

Industries follow

In industry after industry, you'll find leading companies are setting the pace for efficient, reliable steam production with C-E Vertical-Unit Boilers.

The Chemical Industry is a typical example. For VU Boilers have been purchased by most of the major manufacturers in this industry, including such nationally-known leaders as those shown in the list below.

Furthermore, chemical manufacturers, both large and small, have *proved* their satisfaction with Vertical-Unit Boilers by buying them again and again. In 1951, for example, more than 60 per cent of the VU capacity ordered by chemical companies represented repeat order business. One leading manufacturer, in fact, has purchased twenty-seven units during the past twelve years — *eleven of them in 1951!*

You can profit from the experience of the Chemical Industry — as from any industry where steam for power or process is of major importance. If you use steam, investigate the lower steam costs you can get through the advanced design . . . sound construction . . . proved reliability of VU Boilers. They are available in capacities to fit your needs—from 10,000 to 350,000 pounds of steam per hour.

Typical List of Chemical Companies that have purchased VU Boilers for one or more plants

Air Reduction Co., Inc.
Allied Chemical & Dye Corp.
Atlas Powder Co.
Carbide & Carbon Chemical Corp.
Colgate-Palmolive-Peet Co.
Diamond Alkali Co.
E. I. du Pont de Nemours & Co., Inc.
B. F. Goodrich Chemical Co.
Hercules Powder Co.
Merck & Co., Inc.
National Distillers Chemical Co.
Pennsylvania Salt Mfg. Co.
Pittsburgh Coke & Chemical Co.
Charles Pfizer & Co.
Shell Chemical Co.
U. S. Industrial Chemicals Co.

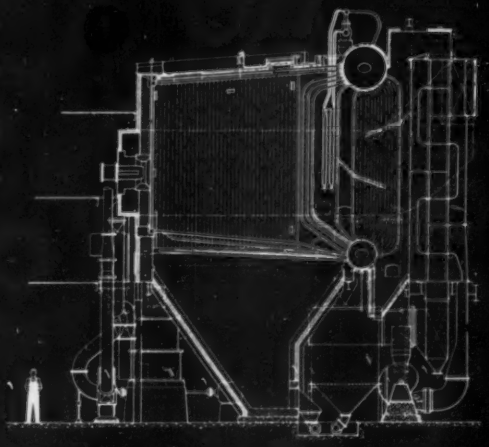
C-E

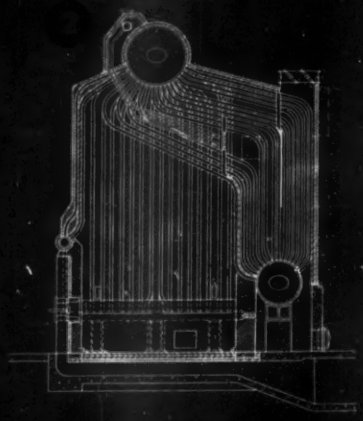
COMBUSTION ENGINEERING—SUPERHEATER, INC.

200 Madison Avenue • New York 16, N. Y.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL

VU

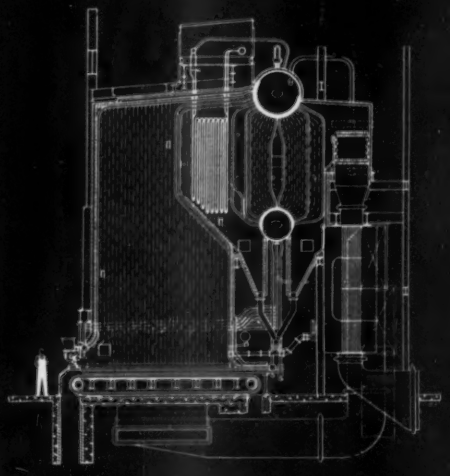




1 VU-50 BOILER installed in Midwestern plant. This boiler is fired with pulverized coal using C-E Raymond Bowl Mills. The capacity is 65,000 lb of steam per hr. Steam pressure is 400 psi — steam temperature is 600 F.

2 VU-10 BOILER fired with oil. Installed in an Eastern plant, the boiler's capacity is 15,000 lb of steam per hr at 250 psi and 480 F. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr. They may also be fired by spreader, underfeed or chain grate stokers.

3 VU-40 BOILER installed in a large Southern plant. This unit is fired by coal, using C-E Spreader Stokers (continuous discharge type). Capacity of this boiler is 150,000 lb of steam per hr at a pressure of 900 psi and a temperature of 808 F.



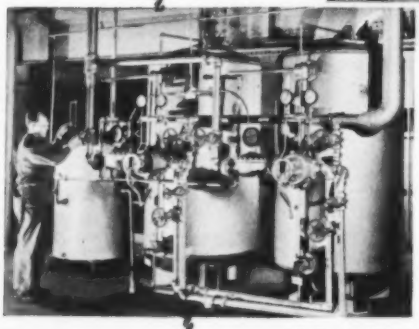
ALLIS-CHALMERS

Water Conditioning

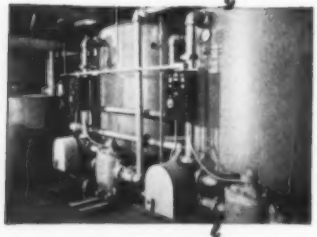
CHEMICALS — EQUIPMENT — SERVICE

FOR WATER *that Fits Your Needs*

This hot process lime-soda softener for treating makeup to high-pressure boilers is rated at 5000 gph.



Sodium zeolite water conditioning equipment with capacity of 130 gpm provides boiler makeup to evaporator in an eastern utility power plant.



Dual automatic sodium zeolite water softener rated at 225 gpm is used in power plant of a Texas hospital.

TO ASSURE YOU water conditioned to your specific requirements, A-C engineers can draw on years of experience treating all types of water . . . plus a broad background of building turbines and processing equipment that are dependent on properly treated water. A-C water conditioning service includes:

Chemicals — for external and internal boiler water treatment . . . designed for silica removal and control of scale, corrosion and carryover. Also cooling cycle treatments . . . and dependable reagent chemicals.

Equipment — hot and cold process softeners . . . sodium and hydrogen zeolite softeners . . . alkalinity-reducing ion exchangers . . . deionizers . . . degasifiers . . . deaerating heaters . . . chemical feeding equipment . . . pumps . . . oil removal and water filters.

Comprehensive consultant service — surveys, reports . . . chemical and X-ray analysis . . . special studies.

WRITE FOR THESE BULLETINS

28X7636 — Meaning, Application and Measurement of pH

28X7559 — Hot Process — Hot Zeolite System

2886611 — Hot Process Softener

2887107 — Sodium Zeolite Softener

28X7808 — Alkalinity-Reducing Ion Exchanger

ALLIS-CHALMERS

A-3827

Milwaukee 1, Wisconsin

Remember the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

Streamline your purchase of welding fittings

Scrappy says, "Aid defense—more scrap today... more steel tomorrow."

Write Dept. C-8 for free booklet listing properties of pipe and welding fitting and flange materials.

JUST AS THE USE of welding fittings streamlines a piping system so does the standardizing on TUBE-TURN Welding Fittings streamline your purchasing operations.

The TUBE-TURN Welding Reducer, both in the concentric type shown here and the eccentric type, is available in a complete range of sizes, wall thicknesses and types of materials. This is another example of how the complete TUBE TURNS' line is designed to meet all your requirements. It covers over 4000 different items. Thus you can simplify ordering and deliveries for any piping job by obtaining all your welding fittings and flanges from one reliable source . . . your TUBE TURNS' Distributor. You'll find one in every principal city.

Be sure you see the double "tt"

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

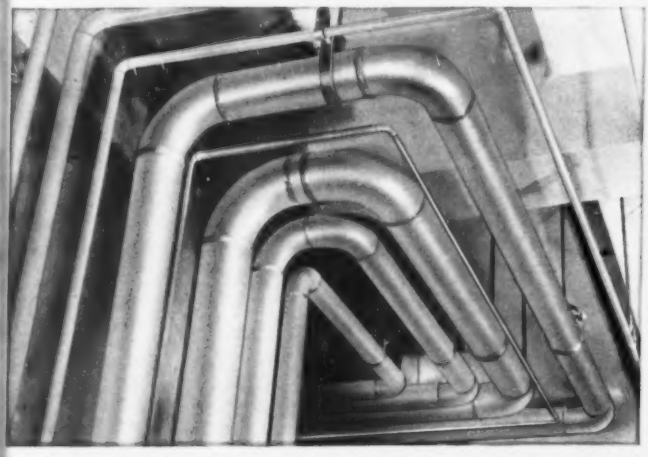
DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles
TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO... A wholly owned subsidiary of TUBE TURNS, INC.

30 Stories of New Building Ideas
...includes maintenance-free welded piping

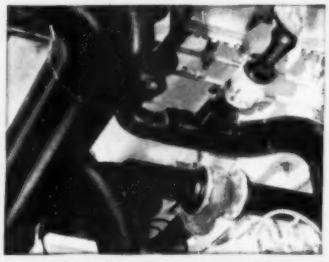
ALUMINUM COMPANY OF AMERICA'S new 30-story office building in Pittsburgh is a pacesetter for construction ideas. Exterior walls are made of sheet aluminum. Windows pivot on vertical axes to simplify cleaning. Radiant heating and cooling panels in ceilings increase rentable floor space.

In keeping with this progressive design, a welded piping system, using TUBE-TURN Welding Fittings and Flanges, was specified. Thus piping, both aluminum and steel, will be leak-proof and maintenance-free. The variety of welding-fitting requirements posed no problem, since TUBE TURNS, INC. offers the world's broadest line of welding fittings and flanges—available in a wide range of types, sizes, and more than 40 different metals and alloys.

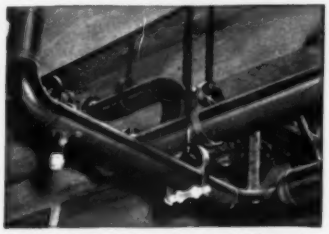
Alcoa's new office building. Architects: Harrison & Abramovitz. Assoc. Architects: Mitchell & Ritchey and Altenhof & Bown. Heating, Ventilating & Air Conditioning Sub-Contractors: Dravo Corp.; Plumbing Contractors: Sauer, Inc.



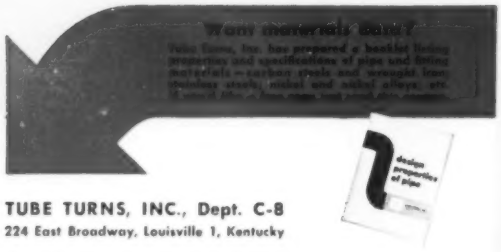
Corrosion-resistant aluminum lines for drinking, and hot and cold water supply saved critical copper. Note how welded lines, from 1" up, are fitted closely together, make for a neat installation. These lines will be insulated.



TUBE-TURN Welding Elbows, Tees, and Reducers used in steel piping for steam and hot water lines in basement. True circularity and uniform wall thickness of TUBE-TURN Welding Fittings expedited installation by insuring accurate fit.



Eight-inch steam line with 2" and 3" branches in fan room on roof. Use of welded system, with TUBE-TURN Welding Fittings, simplified piping design, gives streamlined appearance, eliminates maintenance problems.



TUBE TURNS, INC., Dept. C-8
224 East Broadway, Louisville 1, Kentucky

Your Name .....
Position .....
Company .....
Nature of Business .....
Address .....
City ..... State .....

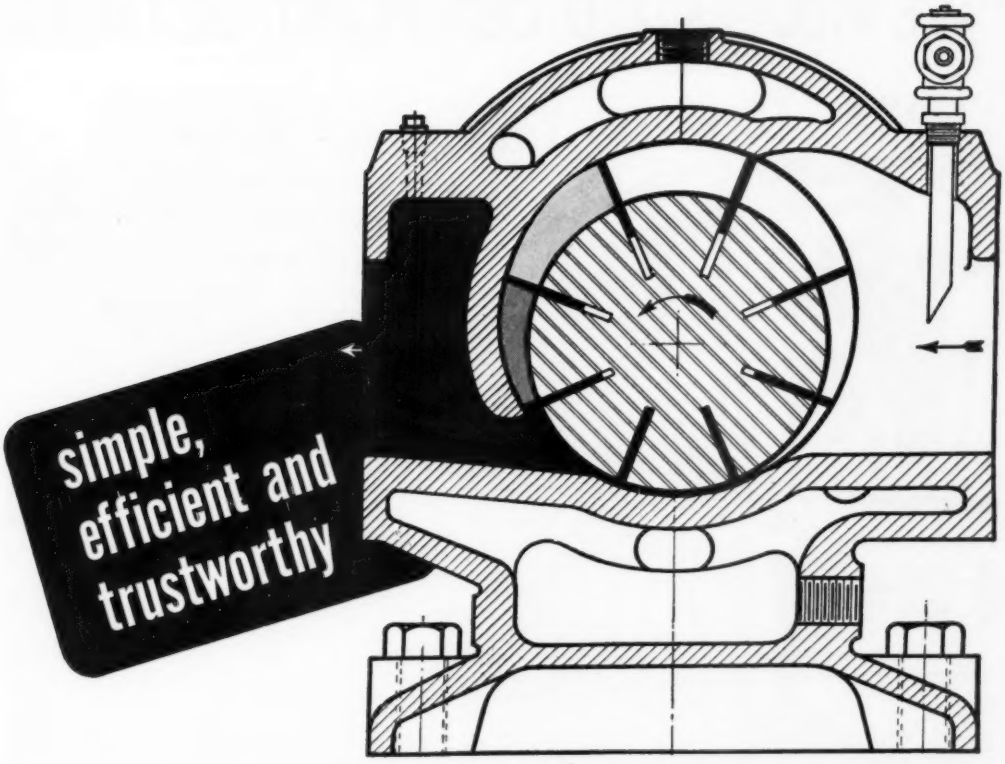
DISTRICT OFFICES

New York	Houston
Philadelphia	Tulsa
Pittsburgh	San Francisco
Chicago	Los Angeles

"tt" and "TUBE-TURN" Reg. U. S. Pat. Off.

TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY



the FULLER ROTARY COMPRESSOR

For compressing gas, no reciprocating compressor can compare in simplicity and operation with a rotary.

PRINCIPLE IS SIMPLE

An eccentrically mounted, accurately machined rotor, with integral shaft, is supported on roller bearings in each of the heads. The eccentric rotor mounting leaves a crescent-shaped space, which is divided into compartments by wear-compensating blades. These slide freely in milled slots in the rotor, and are held, pressure tight, against the cylinder solely by centrifugal force. These compartments vary from minimum to maximum on the suction side, and from maximum to minimum on the compression half of the revolution. Properly designed blades, and a wide seal between rotor and bottom of cylinder, assure high and **maintained** volumetric efficiency; the multiple blades minimize pressure differences between compartments and contribute to maximum output with minimum wear.

OPERATION IS EFFICIENT

The Fuller Rotary Compressor assures a smooth flow, with no pulsations ... numerous displacement deliveries per revolution as against one in a single-cylinder piston compressor. Other advantages are: Direct drive; Compact installation; Simple foundations; Maintained capacity and efficiency; and No valves to leak. Because there are few moving parts —rotor, blades, and bearings, **maintenance time and costs are negligible.**

For further information on Fuller Rotary Compressors that will do a better job for you, write for Bulletin C-5.

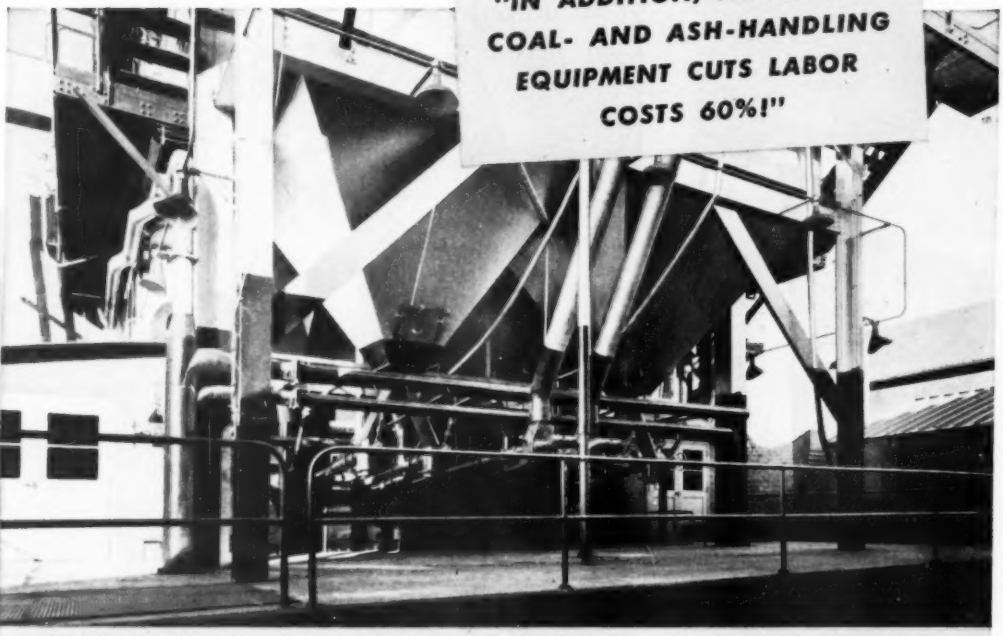
Fuller

DRY MATERIAL CONVEYING SYSTEMS
AND COOLERS • COMPRESSORS AND VACUUM PUMPS
FEEDERS AND ASSOCIATED EQUIPMENT

FULLER COMPANY
Catasauqua, Pennsylvania
Chicago 3—120 So. LaSalle St.
San Francisco 4—420 Chancery Bldg.

C-218

"WE MODERNIZED OUR PLANT, INSTALLED



This view shows how River Raisin has installed its modern fly-ash re-injection system at the rear of the boilers but outside the plant. The plant also features outdoor coal handling to save additional interior space. Coal is delivered to the stoker hoppers through automatic scales which weigh and record the flow.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY—FOR LOW COST

NEW COAL-BURNING EQUIPMENT, AND CUT OUR FUEL COSTS 45%!"

says Mr. A. J. Goetz, Executive Vice President, River Raisin Paper Co., Monroe, Michigan.

"We recently modernized our entire plant following an extensive engineering survey. New coal-burning equipment was installed...our coal-handling system was redesigned...heat losses were reduced...efficiency raised. As a result, our fuel costs have been cut 45 to 50%—proving to us that for economy and efficiency you just can't beat bituminous coal burned the modern way."

"These modern spreader stokers fully meet the special requirements of our operation. They feature low power requirements, low maintenance, and have the ability to meet fairly rapid load changes. They give us maximum efficiency under all operating conditions."

Modernizing your present plant? Building a new one? In either case it will pay you to get the *modern* facts about coal from a consulting engineer. He'll show you how an up-to-date coal installation can meet your *specific* needs—and at the same time save you more money than you thought possible.

With automatic coal- and ash-handling equipment you can cut labor costs to a minimum . . . and a modern combustion installation will give you more steam for less fuel. Actually, today, you can get from 10 to 40% more power from each ton of coal than was possible a few years ago.

And, if you burn coal, you'll never have to worry about a shortage of fuel. America's coal reserves are virtually inexhaustible, and this coal is mined by one of America's most efficient and productive industries.

This means that coal users—unlike those committed to other fuels—get the advantage of dependable future supply as well as the most stable prices.

BITUMINOUS COAL INSTITUTE
A DEPARTMENT OF NATIONAL COAL ASSOCIATION
WASHINGTON, D. C.

YOU CAN COUNT ON COAL!

B&W EXPANDS FOR

MORE

Many new B&W boilers are under construction and on order to supply steam requirements for several million kilowatts of new generating capacity.

POWER FOR AMERICA

Keeping pace with the nation's continuing industrial expansion, The Babcock & Wilcox Company is completing this year a multi-million-dollar increase in facilities for the manufacture of boilers for electric generating stations, industrial plants, institutions, public buildings and apartment houses, chemical plants, oil refineries, and merchant and naval vessels.

Two new plants are already in production at Wilmington, N. C. and West Point, Miss. A third one is being built at Paris, Texas. Thousands of additional employees have been trained to man these new plants, and to work expanded fabricating facilities at five other B&W plants. New machines and processes . . . including the world's largest boiler plate press . . . are setting new standards of production efficiency and speed.

Through its expanded facilities for production of more steam generating equipment, B&W shares in America's dynamic urge to accomplish as reflected in industry's phenomenal, growing capacity to mass produce.

BABCOCK & WILCOX

G-570T

Could You Use SAVINGS *Like These?*

40% less
Fuel Consumption
50% more
Boiler Capacity

Bailey Meters and Controls Insure Savings at Kerr Bleaching & Finishing Works, Concord, N. C.

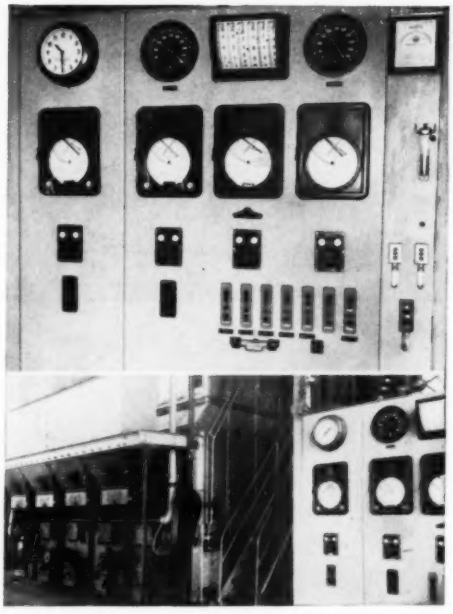
The key to complete returns on any investment in new power equipment is a fully co-ordinated system of meters and controls. It's the old story, the tail that wags the dog—careful attention to this comparatively minor part of the over-all installation cost can mean the difference between profit and loss in operation.

Here's where Kerr Bleaching & Finishing Works has cut operating costs—by installing *co-ordinated* Bailey Meters and Controls. The installation includes Bailey Meter Combustion Control, and Bailey Two-element Feed Water Control.

Such a co-ordinated system is an important plus for Bailey customers. Nowhere else can you buy such a complete range of equipment, selected without bias to do the best job for you. Nowhere else can you find such expert engineering service, immediately available through conveniently located direct sales and service representation. May we help you?

Call our local branch office or write for Bulletin 15-H.

A-113



Control panel, showing completely co-ordinated Bailey Meters and Controls at Kerr Bleaching and Finishing Works, Concord, N. C.

BAILEY METER COMPANY

BAILEY METERS

1040 IVANHOE ROAD
CLEVELAND 10, OHIO

Controls for Steam Plants
COMBUSTION · FEED WATER
TEMPERATURE · PRESSURE
LIQUID LEVEL · FEED PUMPS

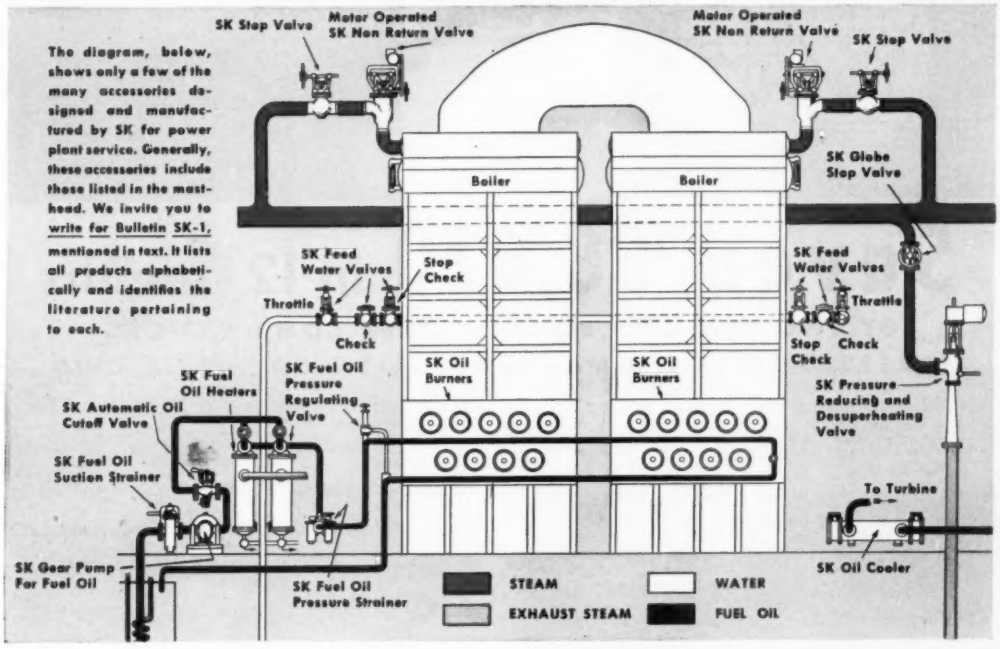
TRADE PAPER EDITION
Published by
SCHUTTE and KOERTING Company

ENGINEERING News

JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSERS AND VACUUM PUMPS • OIL BURNING EQUIPMENT •

WANT ENGINEERING ASSISTANCE IN APPLYING HIGH PRESSURE POWER PLANT ACCESSORIES?

The diagram, below, shows only a few of the many accessories designed and manufactured by SK for power plant service. Generally, these accessories include those listed in the masthead. We invite you to write for Bulletin SK-1, mentioned in text. It lists all products alphabetically and identifies the literature pertaining to each.



You can get it from us.

For over 75 years, SK has specialized in *engineered products for the power plant.*

In that time, the company has worked closely with thousands of power and consulting engineers to properly apply accessories ranging from standard fuel oil burners to specially engineered multi-nozzle pressure reducing and desuperheating valves.

Those who don't realize the *economic importance* of years of service and wide experience belittle these intangibles.

Just you remember — the design or manufacturing problem we solved yesterday or seventy-five years ago can well provide the basis for solving a problem of your own *at lower cost* than would otherwise be possible. And, remember that every technique perfected at some previous time, every pattern, tool, and machine already on hand means *less cost to be passed along to you.*

Do you want help on some specific power plant problem? Write us, and we will have one of our field engineers visit you.

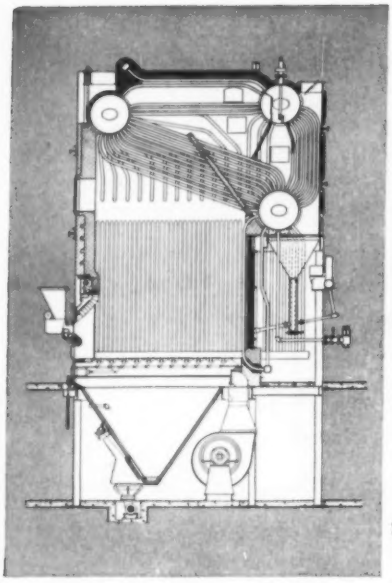
Want some idea of the many accessories we manufacture? Send for a copy of Bulletin SK-1, "Index of SK Equipment and Descriptive Bulletins," look it over, and write for the specific technical literature you need.

SCHUTTE and KOERTING Company

Manufacturing Engineers

CORNWELLS HEIGHTS, BUCKS COUNTY, PA.

REPRESENTATIVES IN PRINCIPAL CITIES



USER
Reeves Steel & Mfg. Co.
Dover, Ohio

BOILERS
2—ERIE CITY
Type 4-C 3-drums

CAPACITY
2-Boilers
45,710 lbs. steam/hr.

FEEDWATER TEMP.
218-220

OPERATING PRESS.
145-150 lbs.

STOKERS
2—ERIE CITY Dumping
Grate Spreaders
Lbs. Coal/hr.
2-Boilers 5322

COAL
Ohio Strip Mine
Nut & Slack (10,500 B.t.u.)

Saved $68,670 in 12 months

BY TWO ERIE CITY BOILER-STOKER COMBINATIONS
at REEVES STEEL and MANUFACTURING CO., *DOVER, OHIO*

It is estimated that the entire cost ($225,000) of revamping the old boiler plant will be amortized in 39 months. This cost includes the removal of an old coal trestle, coal handling equipment and the two old boilers. Also included are the costs of 2 new Erie City Spreader Stoker-Steam Generators, new coal storage and ash handling facilities, 300 ft. of new steam header and extensive building changes. The 1951 savings are shown at the left.

1951 SAVINGS

	Savings
Coal for 1951	10,682 Tons
Fuel Cost	$38,578
Operating Labor	$ 9,353
Service Dept. Charge	$ 4,677
Repairs & Maint.	$16,062
1951 Savings	$68,670

You can depend on Erie City for sound engineering

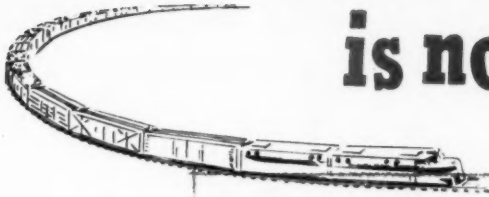
ERIE CITY
112 Years in Steam Generation

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

working on the railroad

is now 50% faster



An installation of Yarway Impulse Steam Traps on sand dryers convinced this railroad that Yarways were best for them. With Yarways, sand was dried in half the time! More important—in a 24-hour period, *twice the amount of sand can be handled.* Now they are standardizing on Yarway Impulse traps.

In all kinds of plants Yarway Impulse Steam Traps help increase production by *getting equipment hot in a hurry—and keeping it hot.*

Users like these additional features of Yarway Impulse Traps, too—one moving part, low maintenance, small size, good for all pressures, low cost. Over 800,000 Yarways have been installed. More than 200 Industrial Distributors stock and sell them.

TRY A TRAP—FREE!

Be convinced. Install a Yarway Impulse Steam Trap on free trial anywhere in your plant. Send us a card and we'll send you the trial trap. For steam trap advice, call your nearby Yarway trap engineer.

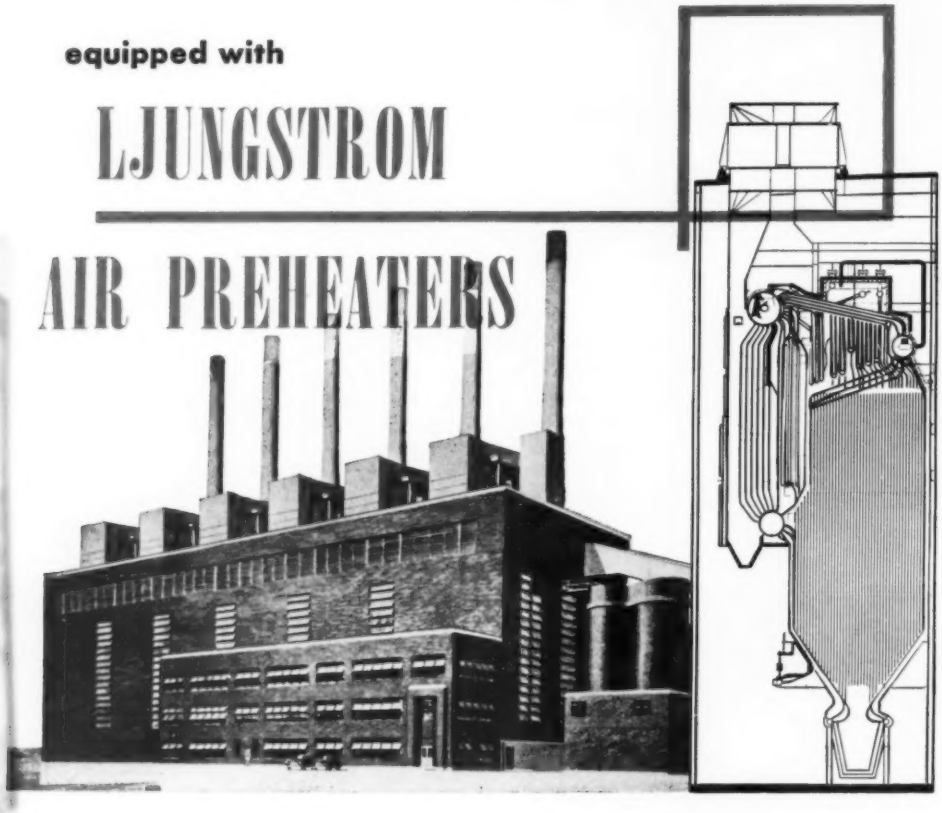
YARNALL-WARING COMPANY
114 Mermaid Ave., Phila. 18, Pa.

YARWAY the steam trap
designed with more production in mind

Three Boilers at Noblesville Station of the Public Service Company of Indiana

equipped with

LJUNGSTROM AIR PREHEATERS



Public Service Company of Indiana, in its post-war expansion program, has added hundreds of thousands of kilowatts for the increasing needs of rural and industrial midwest.

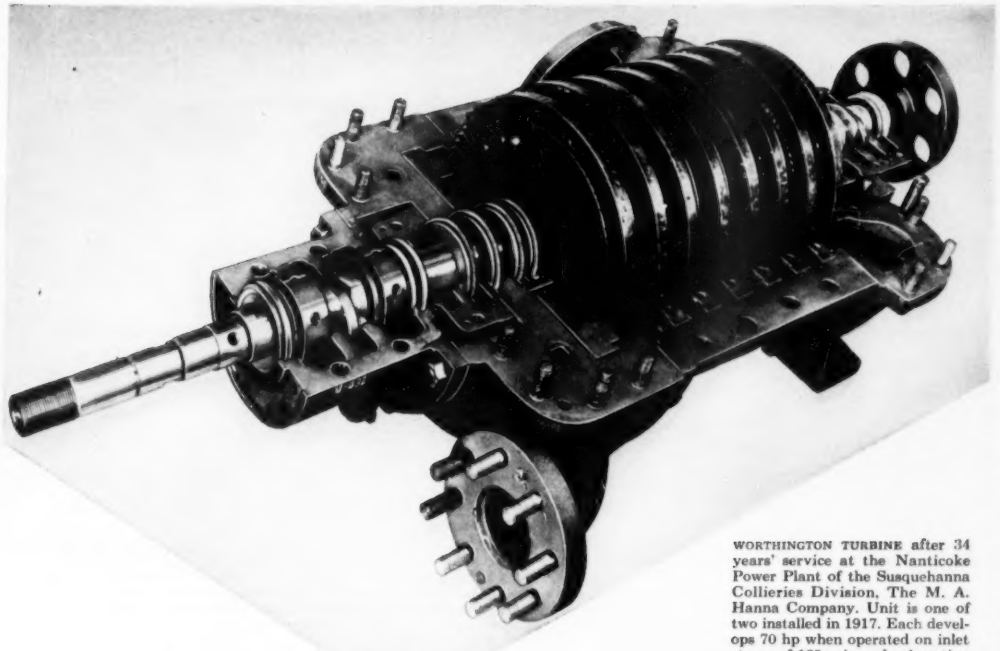
The latest new station to go on the line is Noblesville Station, designed by Sargent & Lundy, Chicago, to add 90,000 KW to this utility's power output. Noblesville utilizes three Riley Steam Generating Units. Each unit is pulverized coal fired, with a capacity of 300,000 lb of steam per hr at 1025 psi and 950 F.

Each Riley unit is supplied with a Ljungstrom Air Preheater, which preheats combustion air to 650 F, cools exit gas to 288 F before it enters the stack.

The unanimity with which Ljungstrom Air Preheaters are chosen for high efficiency steam generating units like these is the best evidence of their high thermal efficiency and dependability. Every boiler manufacturer has included Ljungstrom Air Preheaters in outstanding installations made during the past few years.

THE Air Preheater Corporation

60 E. 42nd St., New York 17, N. Y.



WORTHINGTON TURBINE after 34 years' service at the Nanticoke Power Plant of the Susquehanna Collieries Division, The M. A. Hanna Company. Unit is one of two installed in 1917. Each develops 70 hp when operated on inlet steam of 125 psig and exhausting to atmospheric pressure.

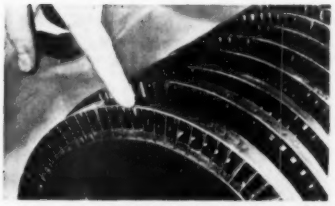
This reconditioned Worthington Turbine has seen 34 years' service

Installed in 1917, this Worthington steam turbine will probably go on to serve the Nanticoke Power Plant of the Susquehanna Collieries Division, The M. A. Hanna Company, for many years to come.

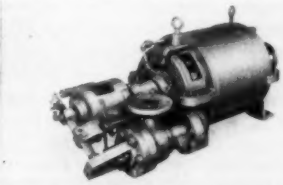
This unit is one of two that for 34 years have been driving induced draft fans—and was recently returned to Worthington's Wellsville, N. Y., plant for reconditioning.

Whether your requirements call for 70 hp or 24,000 hp, the complete Worthington line offers you the right steam turbine for your mechanical drives—a rugged performer that's ready to serve you economically and give you years of uninterrupted service.

Worthington Corporation, Steam Turbine Division, Wellsville, New York.



CLOSE-UP OF TURBINE BLADING shows that, except for a few single insertions, it remains the same as when turbine was installed 34 years ago.



COMPLETE TURBINE—ONE OF THE TWO that have been driving fans for Susquehanna Collieries since 1917.

T.2.3

A GREAT TEAM IN STEAM

WORTHINGTON

Steam Turbines

SPECIALLY DESIGNED 500 GPM WORTHINGTON TREATING SYSTEM at the new Pemex natural gas refinery in Poza Rica, Mexico. System includes cold-process slurry-type softener followed by acid feed, filtration and zeolite treatment. Engineered by Arthur G. McKee Company.

Specially Designed for Intermittent Service

Softening system for boiler feed water built for short-period operation, long shutdowns

Water conditioning requirements are especially tough at the new Pemex natural gas refinery in Poza Rica, Mexico.

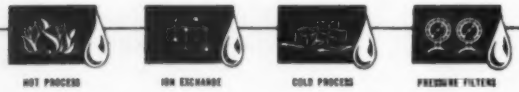
Their need for variable-rate, continuous-service softener operation is complicated by the intermittent boiler feed-water storage demands.

Pemex's conditioning requirements have been met by a specially built Worthington system, so designed that the slurry bed is not lost during "off-service" periods. The bed resumes its normal suspended position at the instant service is resumed. This avoids the irregular treatment, delay and water waste common in systems that require creation of a new slurry bed after each shutdown period.

New Bulletin W-212-B5 gives you the vital facts about this unique cold process water softening method. Write for your free copy today.

Worthington engineers and builds equipment for all the major types of water-conditioning systems, therefore is in an excellent position to give comprehensive and well-balanced recommendations on your water-conditioning equipment problems . . . further proof that *there's more worth in Worthington*. Worthington Corporation, Water Treating Section, Harrison, N. J.

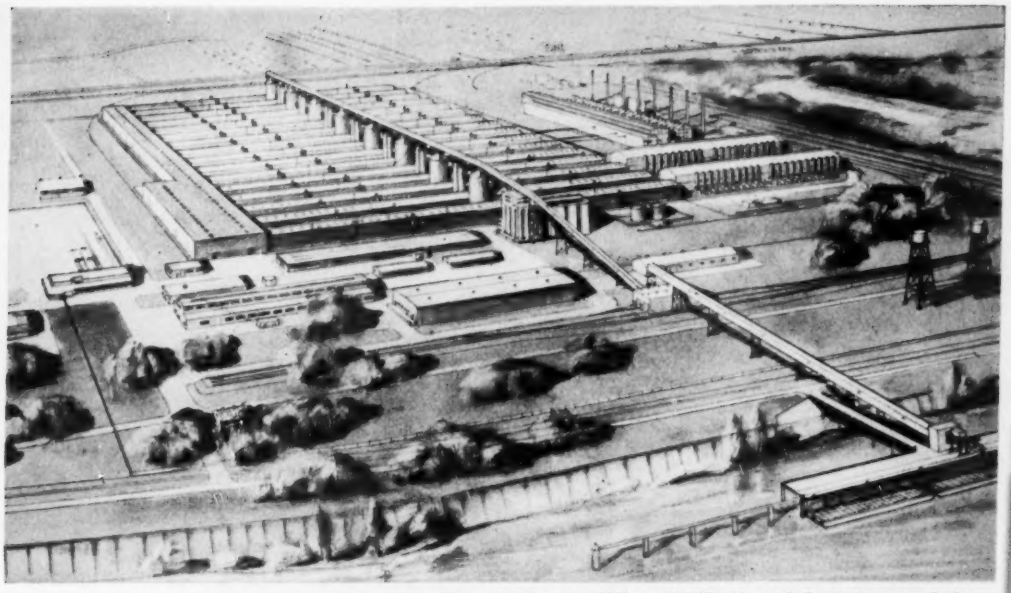
J.1.3



Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON

Water Conditioning



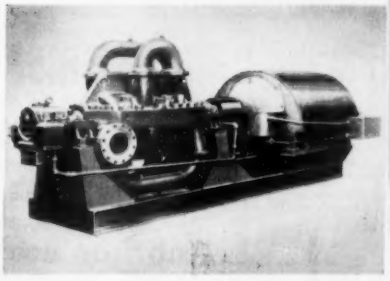
KAISER ALUMINUM AND CHEMICAL CORPORATION'S new 400,000,000 pound-a-year, $150,000,000 aluminum reduction plant at Chalmette, La., designed and built by Kaiser Engineers, is the largest plant of its kind in the U. S. The plant—where production began in December, 1951—uses 19 Worthington boiler-feed pumps and other Worthington equipment including thirty 9,300 square-foot condensers, and fifteen 250,000 pound-per-hour deaerators, 2 steam turbines and numerous circulating pumps.

Power plant at largest aluminum reduction plant to use Worthington pumps, condensers, deaerators

It takes plenty of electric power to produce 400,000,000 pounds of aluminum in a year. And that's what they're doing at the new Kaiser Aluminum plant at Chalmette, La.—largest aluminum reduction plant in the U. S.

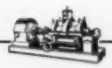
Kaiser joins many other top companies in choosing Worthington boiler-feed pumps as well as other key equipment for their new plant. Such choices arise out of an insistence for equipment that's engineered for maximum performance.

Worthington engineering produces boiler-feed pumps of the most advanced design in the field, made from specially selected metals. Each pump is exactly *right* for the pressure and temperature with which it is to perform. Over 110 years of Worthington experience in building pumping equipment go into making this a certainty. Worthington Corporation, formerly Worthington Pump & Machinery Corporation, Centrifugal Pump Division, Harrison, New Jersey. C.2.4



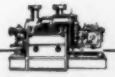
19 WORTHINGTON 250,000 LBS PER HR BOILER-FEED PUMPS at new Kaiser plant, handle feedwater at 257 F against a discharge pressure of 1,030 psig. Pumps are axial-balanced, volute type centrifugals. Two, similar to one illustrated, are driven by Worthington 450-hp steam turbines.

For Boiler Feed Service. Capacities to 1,500 GPM; Heads to 1,000 feet.



For Hotwell, Condensate, Chilled Water Service. Capacities to 1,400 GPM; Heads to 650 feet.

For Water Works, Circulation, Drainage, General Service. Capacities to 135,000 GPM; Heads to 400 feet.

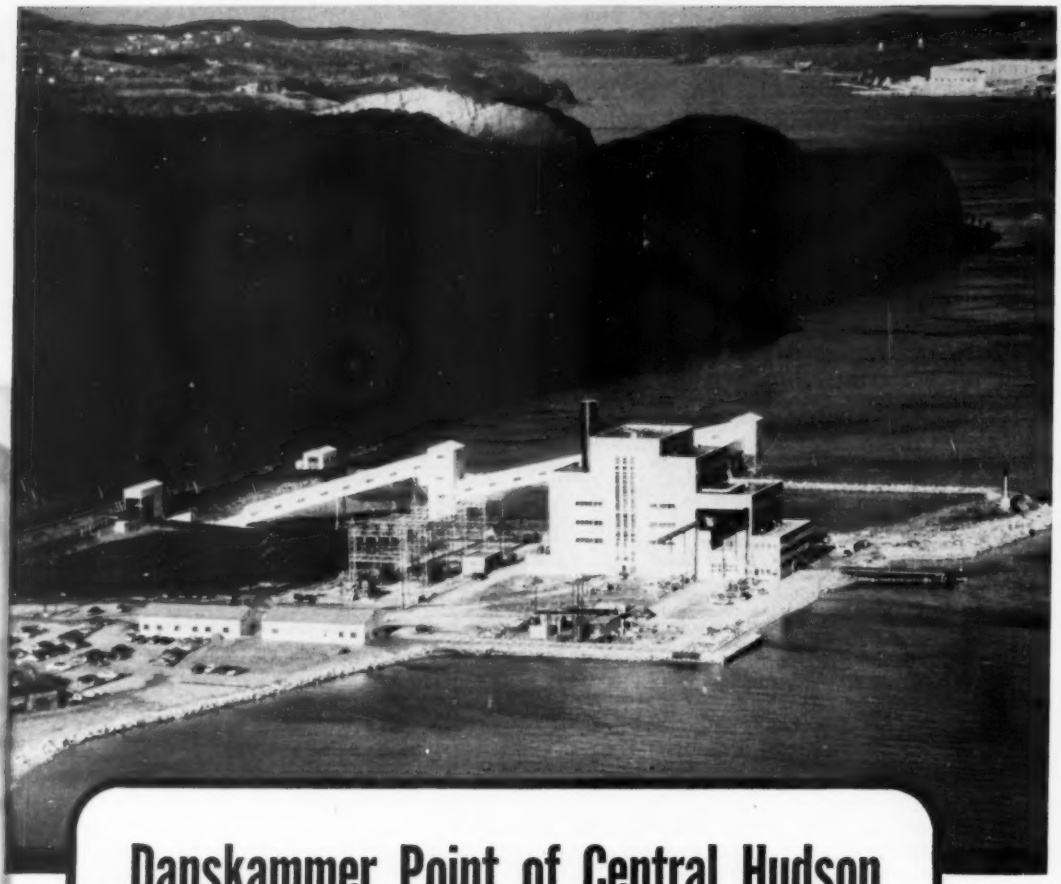


For Boiler Feed Service. Capacities to 3,000 GPM; Heads to 7,000 feet.

WORTHINGTON

Centrifugal Pumps

The World's Broadest Line Assures You the Right Pump for Every Job

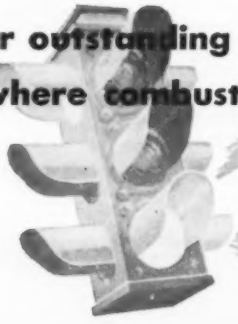


Danskammer Point of Central Hudson

"The New Look in the Hudson River Valley"

Engineered by
Burns & Roe, Inc.

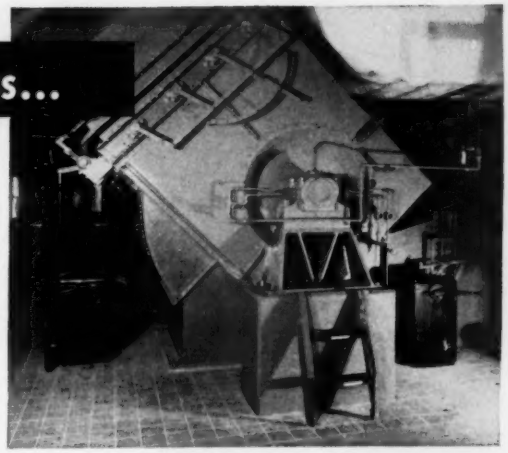
Another outstanding steam generating plant where combustion air and gases



GO on GREEN

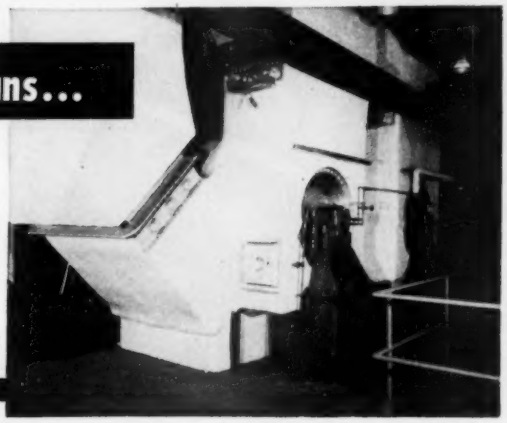
Two Green Forced Draft Fans...

operating in parallel on one boiler; each is designed to deliver 75,000 cfm of air at 125°F against 12.5 inches static pressure while running at 1175 rpm; special control type inlet dampers; standard control type outlet dampers; constant speed motor.

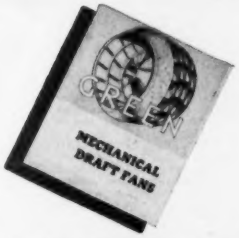


Two Green Induced Draft Fans...

operating in parallel on the same boiler as the F.D. Fans, each is designed to handle 126,000 cfm of gas at 335°F against 17 inches static pressure while running at 850 rpm; shut-off dampers at inlet and outlet; gyrol fluid drive.



Danskammer Point Station of Central Hudson Gas & Electric Corporation, has the reputation of being one of the most efficient plants in the country, with a fuel record of less than 8/10 pounds of coal per kw. These four Green Fans, because of their design efficiency and careful construction, are playing an important part in this production record. And the service they are giving is being duplicated in many utility and industrial steam generating plants throughout the country. In keeping with the requirements of dependable service, such plants "Go on Green" fans.



Send for our Fan Bulletin 168. If interested in Green Economizers, send for Bulletin 169.

The Green Fuel Economizer Company, Inc.

BEACON 3 **NEW YORK**

Economizers · Fans · Air Heaters · Cindertraps · Aerodyne Dust Collectors

WITH *Nalco* ANTIFOAM TREATMENT

NALCO Antifoam Chemicals, used as a part of Nalco System Water Treatment, consistently produce steam with only 1 to 3 parts per million solids content — and frequently permit more than double the dissolved solids in the boiler water without danger of carryover!

Truly dry steam is a welcome and valuable protection for turbines, pumps, and the entire steam system ...and Nalco Antifoam Treatment makes a simpler problem of control of boiler water dissolved solids, since it prevents carryover at concentrations far exceeding average practices.

Your Nalco Representative can show you copies of actual steam quality charts that are typical of the *before* and *after* performance of Nalco Antifoam Treatments — *but the best proof is in your own boilers* ... Call or write, today.

1. PURE DISTILLED WATER has no dissolved solids; produces big steam bubbles that burst instantly at surface as shown in Nalco Laboratories test tube boiler.

2. BOILER WATER has high dissolved solids; small bubbles with foaming tendencies cause carryover and impure steam.

3. BOILER WATER WITH NALCO ANTIFOAM Treatment — same water as in Photo No. 2 — now produce large bubbles without foam and pure steam ... the same results as distilled water.

Photos in Nalco Laboratories — unretouched.

... and PRECISION-CONTROLLED BLOWDOWN

● Precision control of boiler blowdown is assured with the Nalco Meterblo Valve... Large, easy-to-read settings ... quick-opening and closing...can be mounted in 16 different positions without special fittings. Now available through your Nalco Representative ... or write direct.

NATIONAL ALUMINATE CORPORATION
6224 West 66th Place **Chicago 38, Illinois**
Canadian inquiries should be addressed to Alchem Limited Burlington, Ontario, Canada

THE *Nalco* SYSTEM • **Serving Industry through Practical Applied Science**

Helpful Bulletins

THE ANSWERS to many of your operating and maintenance problems are found in these new and recently revised catalogs and bulletins. List the paragraph numbers of those you want on the cards on page 123, detach and mail

VALVES, TRAPS AND PIPING ACCESSORIES

101 Electrically Operated Relief Valves — Bulletin 720, 8 pp, describes company's automatic, electrically actuated pressure relief valves for boiler service. Included are charts and photos of system elements as well as entire relief valve system encompassing valves, controller and control stations. System is designed to assure more accurately balanced boiler operation at peak loads while conserving power and reducing maintenance of spring-loaded safety valves, which these valves are intended to supplement. Manning, Maxwell & Moore, Inc.

102 Safety Relief Valve — Bulletin 290, 4 pp, features safety relief valve Type F-51, designed to safeguard hot water heating boilers, storage tanks and heaters. ASME approved, valve has highest Btu discharge rate of any safety valve of comparable size, according to bulletin. Dimensions, shipping weights and prices of this and company's Type E valve are given. A. W. Cash Valve Mfg. Corp.

103 Hydraulic Check Valves — Bulletin WS-1 describes hydraulic double cushioned check valves. Two detailed drawings show complete list of parts. Application, construction, sizes and pressures are covered, and dimensions given. Golden-Anderson Valve Specialty Co.

104 Packless Expansion Joints — Bulletin 35-51A offers 28 pp of up-to-date information on company's Corruflex joints, their design and advantages in providing for thermal expansion in pipelines. Construction features are explained and illustrated; simplified selection data includes tables for determining amount of expansion in pipelines. A chapter on installation discusses anchoring, alignment, traverse limits, use of gaskets, hydrostatic testing. Sizes given; typical piping arrangements are sketched. American District Steam Co., Inc.

105 Expansion Joints — Bulletin CMH-119R, 8 pp, describes manufacturer's new Flexon line of expansion joints, in which recent design changes have produced joints capable of accommodating increased expansion with fewer corrugations. Gives specifications and installation data on free-flexing joints for low pressure applications, controlled-flexing joints for high pressure installations, also joints for handling extremely high pressures. Fully illustrated. Flexonics Corp.

106 Quick Joining for Pipe — An economical and quickly-used device for joining pipe without threading is introduced in this bulletin. Shows how this joint works, pictures some common applications, tells advantages. Includes specifications for straight coupling, 45- and 90-deg ells, adapters. Quik-Joint Mfg. Co.

107 Steam Trap Book — Catalog J is the 44-pp new edition of this company's popular trap book and serves as a manual of trapping practice. Includes a catalog section giving physical data and prices on cast semi-steel and forged steel inverted bucket steam traps, compound steam traps and ball float air and air relief traps; a handbook section explaining how to calculate condensate loads and select traps for all classes of equipment; a maintenance section explaining trap installation, preventive maintenance, trouble-shooting and repair. Well illustrated, includes numerous charts and tables. Armstrong Machine Works.

108 Brass Fittings — Illustrated in this bulletin are shut-off valves, SAE flare tube fittings, compression fittings, drain cocks, needle valves, pipe fittings. Includes sizes, prices. Universal Brass Corp.

109 Addenda Errata — In all good publications minor revisions are needed from time to time, to cope with typographical errors, coded changes, new information. This booklet covers revisions in company's popular Catalog 211 on the design properties of pipe and is offered to power engineers who use that catalog. It's designed to fit in the pocket of the big catalog to save writing in the changes by hand. Tube Turns, Inc.

PUMPS

110 Controlled Volume Pumps — Bulletin 351, 16 pp, describes company's air-powered controlled volume pumps, designed to pump practically any liquid in measured volumes accurate to within a fraction of 1 per cent. Pumps are reciprocating, positive displacement plunger types. Cross-sectionals show design and operating details. Controls and typical automatic feed systems are discussed. Air consumption and capacity-pressure tables included. Milton Roy Co.

111 Proportioning Pumps — Catalog Up-52, 24 pp, gives full information on a line of mechanical drive U-type metering and proportioning pumps. Full specifications and prices are included, plus a section on selection. This data makes it possible to specify exact pump for any of 300 listed substances handled by these pumps. Hills-McCanna Co.

HEATING, COOLING

113 Hot Water Heating — The company's hot water heating products are thoroughly treated in 8-pp Bulletin T-1941. Special attention is given to a new air-reducer, which is an easily installed fitting for removing air at the boiler. Also discussed are layout and design data for a one-pipe hot water system. Piping details and roughing-in dimensions are included. Book has 22 illustrations. The Trane Co.

114 Cooling Towers — Stressing lower erection and operating costs, greater structural strength, high efficiency of company's TP cooling towers, this 20-pp booklet describes and illustrates construction features which contribute to these factors. Pictures some towers now operating. Hudson Engineering Corp.

115 Heating, Cooling Equipment — This newly-released 8-pp bulletin is a concise picture-book presentation of some of manufacturer's heaters, coolers, condensers and heat exchangers for all types of liquids, vapors and gases. Material is arranged to show equipment of particular interest to the oil and gas industry, power plants, general industrial plants, etc. Brief text accompanies photos of equipment and installations, explaining design features and applications. The Griscom-Russell Co.

INSTRUMENTS, CONTROLS

116 Instrument Reference Bibliography — Bulletin Index 100-A, 20 pp, presents industrial literature available. Consists of both numerical listing and alphabetical cross index for specification sheets, instrumentation data sheets, catalogs. Included in the index are articles from company's publication, "Instrumentation." Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

117 Instrument Data Book — New 42-pp 1952 edition of company's data book and catalog contains up-to-date prices, application recommendations and pertinent information on instrument sensing units and accessories. Essential data to making, checking and ordering thermocouples; wire sizes; and resistance and temperature-millivolt curves applied to indicating, controlling and recording instruments are included. Wheelco Instruments Div., Barber-Colman Co.

118 High Pressure Flow Metering — Catalog 40, 12 pp, describes variable-area flow meters with precise, economical, tapered metal metering tubes. Discusses company's Armored Flowrator meters designed for both high temperature and pressure and for use where liquid hammer and hasardous fluids make some meters impractical or dangerous. Besides providing complete data on various types of these meters, the new catalog features a section on meter extensions and extension combinations available to the armored meter user. Fischer & Porter Co.

TWO POSTAGE-FREE CARDS are provided for you on page 123. List item numbers of all the bulletins you want

119 Time-Proportioned Control — New indicating millivoltmeter controller featuring time-proportioning electronic control is spotlighted in 8-pp Bulletin 1052. Suited for close temperature control in industrial heat-treating applications, the features, applications, characteristics, specifications and details of operation presented. Scale ranges given. Minneapolis-Honeywell Regulator Co.

120 Flow Rate Control — The principle of operation used by company's direct-acting regulators is illustrated in Bulletin 521, which also shows how the simplicity of this principle contributes to accuracy and flexibility in service. Explains performance advantages and economy of the regulators. Describes a few applications. W. A. Kates Co.

121 Data on Pressure Gages — Newly published information on pressure gages is presented in these three specification sheets, each 4 pp. No. 708 describes indicating and recording pressure gages, giving construction and engineering details. No. 709 gives similar data on indicating-recording gages with Electr-O-Vane control. No. 710 covers indicating-recording gages with pneumatic control. All available; state those wanted. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

122 Combustion System Safeguards — Twelve-pp Bulletin SC-1006 describes two protective devices used in the piping systems of gas-and-air combustion systems: an automatic fire check to detect, localize and extinguish a flashback in the gas-air mixture lines, close to the gas burners; and a safety blowout to prevent flashbacks in main supply piping from damaging combustion control equipment and to relieve excessive flashback pressures by diverting shock forces. Selas Corp. of America.

123 Thermocouple Assemblies — Catalog EN-52, 44 pp, offers up-to-date information on company's line of thermocouple assemblies and components for general and special use. In a simplified tabular arrangement, lists accuracy limits of couples, temperature and physical limitations and protecting tube materials. Includes handy margin index to specific sections. Leeds & Northrup Co.

124 Smoke Recorder — Condensed Bulletin 512 describes an instrument for recording stack smoke density and combustion performance. Wiring and installation diagrams included. Esi Instrument Co.

125 Manometer Manual — This 12-pp illustrated bulletin includes basic facts and definitions of pressure measurement. Types of manometers, how they operate, and what they measure are explained. English and metric tables of equivalents are given for readings taken with various indicating liquids, as well as temperature correction factors and tips on their use. King Engineering Corp.

126 Lookin' for Trouble? — Here's an illustrated bulletin on the Electro Probe, an improved low-cost electronic trouble spotter, which indicates by noise meter dial and speaker or headphones. Tells of probe's use in locating motor ailments, vibration sources, finding leaks and stoppages. Erwood, Inc.

127 Crane Hoist Control — A new a-c crane hoist control, the Load-o-matic, is presented in 8-pp Booklet B-5417. Operation of the control is explained by using the analogy of a man raising or lowering a weight manually. Other sections of booklet cover construction, mounting and performance characteristics. Motor speed-torque curves show how Load-o-matic control compares with other forms of crane control in combination with a-c wound-rotor induction motors. Westinghouse Electric Corp.

WATER CONDITIONING

129 Data on Cation Exchange Resin — Now available are 9 pp of technical information on Amberlite IR-112, a medium capacity cation exchange resin possessing desirable physical and chemical properties of the polystyrene nuclear sulfonic acid type materials. Discusses low cost, other advantages of the resin, and tells applications. Physical, chemical, hydraulic and operating characteristics are detailed. Also covered are hydrogen cycle regeneration, exchange capacity. The Resinous Products Div., Rohm & Haas Co.

130 Water Conditioning Data Book — Recently brought up to date and revised, this pocket-size 116-pp booklet presents a compilation of 77 tables, all valuable to the power engineer. Covers such subjects as hydraulics, impurities in water, boiler feedwater make-up requirements, chemical conversions and chemical reactions. Contains excellent reference information on many phases and methods of water treatment. Available without charge to qualified power engineers, please state title when requesting this book. The Permutit Co.

MAINTENANCE

131 Masonry Water Repellent — Technical Data Guide 40 gives details on Hydrocide 8X, a colorless silicone product for making all types of above-grade porous masonry water repellent. Tells what this coating is, how it works. Results of tests covering performance at low temperatures, paintability of treated surfaces, resistance to efflorescence are discussed and advantages explained. L. Sonneborn Sons, Inc.

132 Paint for Brewing Industry — This 10-pp bulletin treats maintenance problems of brewing industry with regard to paint protection and beauty. Illustrated, the bulletin features large flow chart of the industry with recommendations for primers and finish coats for all equipment. Importance of preparation and priming are singled out. Valdura Div., American-Marietta Co.

133 Raincoat for Walls — This small folder describes company's Stonhard, a water repellent liquid chemical for use on brick, concrete, stucco, other masonry surfaces. Explains how Stonseal penetrates to line masonry pores and change the capillary force from that of sucking in water to that of shedding water, at the same time permitting the masonry to "breathe." Stonhard Co.

ELECTRICAL

135 Electrical Contacts — New 12-pp catalog, C-520, describes characteristics and uses of the company's line of electrical contacts. Various materials used for contacts and their properties are examined. Designed to aid in selection and use of contacts, the catalog features an outline showing best contacts for various applications such as in alarms, instruments, circuit breakers, etc. Illustrated. Gibson Electric Co.

136 Motor Control Centers — Bulletin 400, 8 pp, well-illustrated, lists advantages and specifications of standardized modular motor control centers. Ease of adaptability to any plant control system is shown. Included is basic data required to install a typical motor control center. Continental Electric Equipment Co.

138 Self-Bonding Tape — This pamphlet, complete with sample strip of tape, cites features and advantages of the company's multi-purpose electrical insulating tape. Included are electrical, physical and chemical properties important to tape's performance. Instructions for a quick test application of the sample strip are also given. Bishop Mfg. Corp.

CRUSHERS

139 Shredder Ring Crusher — A crusher for coal and similar materials which features rolling shredder rings is described in this 8-pp bulletin. Gives details on a survey of 29 mines and power plants in which this type crusher is installed. Informative tables giving speed, capacity, horsepower, weight and dimensions of crushers, as well as cost data are included. American Pulverizer Co.

140 Choosing a Crusher? — Since operating cost of the "wrong" crusher can become prohibitive, this company has prepared Bulletin 452, a handbook to assist power engineers who, sometime, may want to select a crusher. This 12-pp, well illustrated booklet explains various crushing methods and their application. Discusses the use of impact, attrition, shear, crushing by pressure, rolling compression, gravity impact and closed circuit grinding. Not an ordering catalog, booklet pictures some of company's equipment. Pennsylvania Crusher Co.

METALS

141 Steel Castings Chart — Standard specifications for more than 70 designated classes of steel castings are incorporated in this new summary chart. Covers pertinent data on virtually all general engineering types of steel castings, together with recently adopted specifications and some revisions of previous standards. Essential information included in tabular form covers heat treatment, chemical compositions, etc. Steel Founders Society of America.

(*Continued on page 180*)

SEE PAGE 123 for postage-free cards.
List item numbers of bulletins wanted

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS

A Utility asked:

"Can you help us get our boiler cleaner?"

Dowell Service removed 1,650 lbs. of deposits left after turbining

Dowell was recently called upon to clean a 150,000 pphr. boiler. In a few hours, 1,650 lbs. of deposits were removed even though the boiler had been previously cleaned by turbining!

If you have a cleaning job to be done on boilers or heat exchange equipment, look to Dowell Service. Special liquid solvents are applied according to the technique demanded by the job—filling, spraying, jetting, cascading or vaporizing. No scaffolding or dismantling is necessary—costly downtime is held to a minimum.

Dowell Service is used to clean many different types of equipment—condensers, process towers, pipe lines, storage tanks, boilers, heat exchangers, evaporators, tanks and water wells. Dowell furnishes all necessary trained personnel, chemicals, pump trucks and controls.

Dowell engineers have experience in all kinds of cleaning problems. And Dowell equipment is designed to help them do the best possible job. Call the office or station nearest you for complete information and estimates. No obligation, of course.

Other recent Dowell jobs:

6 black liquor evaporators in a paper mill were cleaned by Dowell Service. The result was a 25% more efficient use of steam.

•

2 fuel oil heaters were cleaned by Dowell Service for a sugar company. Pressure drop was reduced from 60 p.s.i. to 30 p.s.i. and temperature was increased by 40° F.

•

3 heat exchangers in a refinery were cleaned by Dowell Service. After cleaning, one unit could carry the load previously carried by all three.

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

CALL

New York 20	Ft. Worth 2	Atlanta	Mt. Pleasant, Mich.
Boston 16	Chicago 4	Indianapolis	Hamilton, Ohio
Baltimore	St. Louis 8	Louisville	Charleston, W. Va.
Wilmington 99	Kansas City 8	Upper Montclair, N. J.	Salem, Illinois
Richmond 20	Wichita 2	Ardmore, Pa.	Beaumont, Texas
Jacksonville 2	Oklahoma City 2	Anniston, Alabama	Borger, Texas
Buffalo 2	Houston 2	Hattiesburg, Miss.	Midland, Texas
Cleveland 13	New Orleans 12	Lafayette, La.	Wichita Falls, Texas
Pittsburgh 19	Shreveport 69	Dearborn, Mich.	Hobbs, N. Mex.

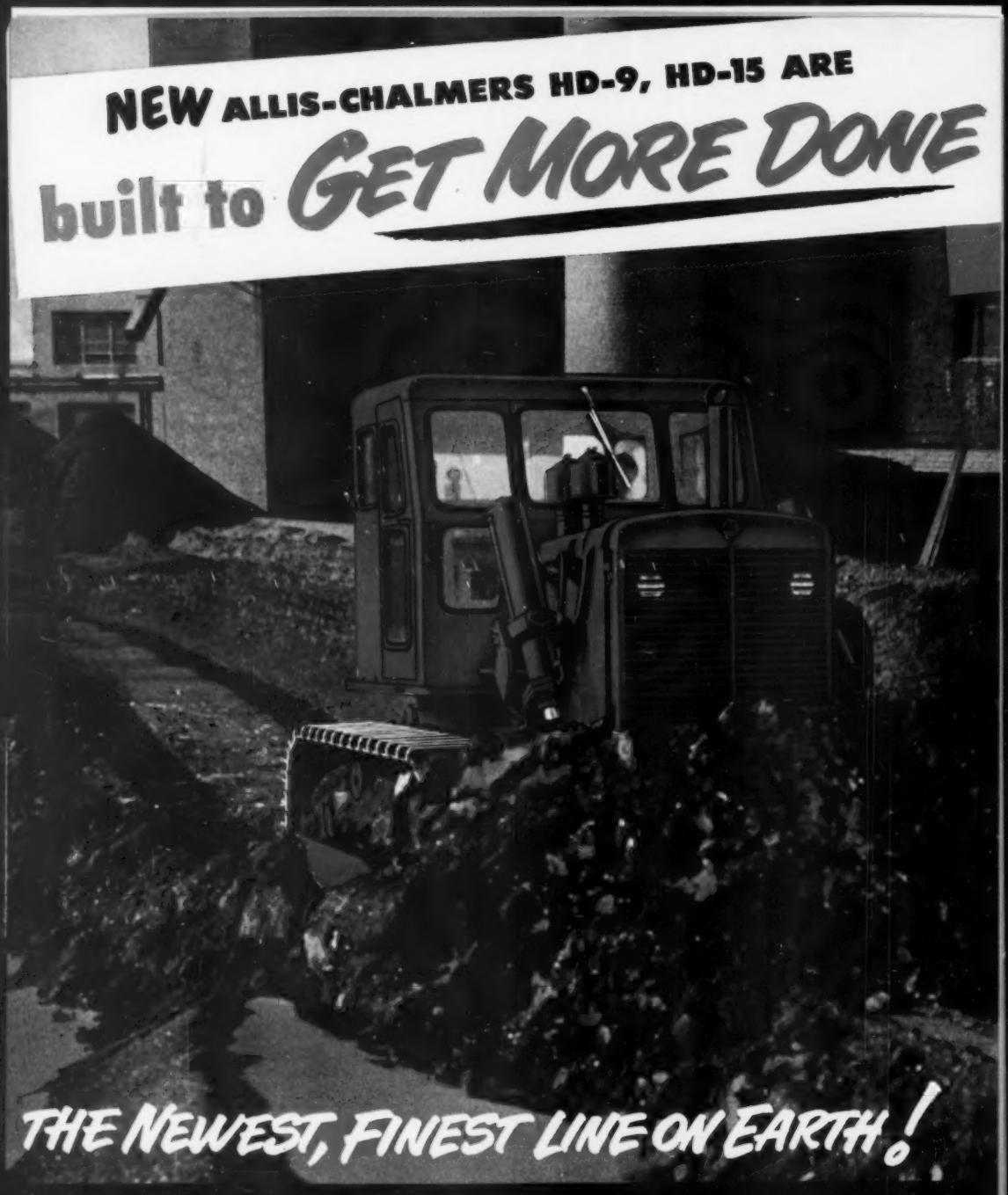
★ *Maintenance cleaning service for industrial heat exchange equipment.*

★ *Chemical services for oil, gas and water wells.*

DOWELL

A Service Subsidiary of

THE DOW CHEMICAL COMPANY



HD-5
40 drawbar hp
11,250 lb

HD-9
72 drawbar hp
18,800 lb

HD-15
109 drawbar hp
27,850 lb

HD-20
Hydraulic Torque Converter Drive
175 net engine hp.
41,000 lb.

built to TAKE IT LONGER

Unequalled Lugability

The HD-9 and HD-15 build up greater drawbar pull faster . . . hold it longer than ever thought possible in gear transmission tractors.

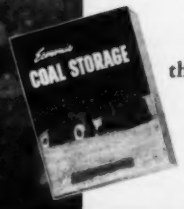
For example, when tough going has pulled travel speed down 40 percent, these tractors will have increased their drawbar pull almost 20 percent over rated pull. They will lug down almost 45 percent from rated travel speed before drawbar pull even starts to fall off.

To take full advantage of this important GM 2-cycle diesel engine characteristic, the HD-9 and HD-15 have longer truck frames, lower idlers and sprockets. That means more track on the ground . . . better stability . . . sure-footed traction . . . unequalled *lugability.*

Extra Long Life

Here are a few of the many reasons why these newest, finest tractors are *built to take it.*

- **All-Steel Welded Construction**
- **More Power with Bigger Engines — Longer Engine Life**
- **More Weight, Greater Strength**
- **Extra Heavy Main Frames — No Extra Reinforcement Needed for Front-Mounted Equipment**
- **Long-Lasting, Large Diameter Clutches**
- **Double Reduction, Straddle-Mounted Final Drive Gears with Live Sprocket Shafts and Caged Bearings**
- **Positive Operating Track Release — Works in Oil**
- **All New, Specially Designed Track Assembly**
- **Positive-Seal Truck Wheels, Support Rollers and Idlers — Mounted on Tapered Roller Bearings, 1,000-Hour Lubrication!**



Your Allis-Chalmers dealer will be glad to explain all of these advantages. See him or phone him now.

• Send for free booklet, "Economic Coal Storage with Allis-Chalmers Tractors." Describes modern coal-handling methods, using A-C tractors and 'dozer blades, front-end loaders and scrapers. Write Allis-Chalmers Tractor Division, Dept. C.

DESIGNED FOR YOUR JOB • BUILT TO "TAKE IT" • EASY TO OPERATE • EASY TO SERVICE

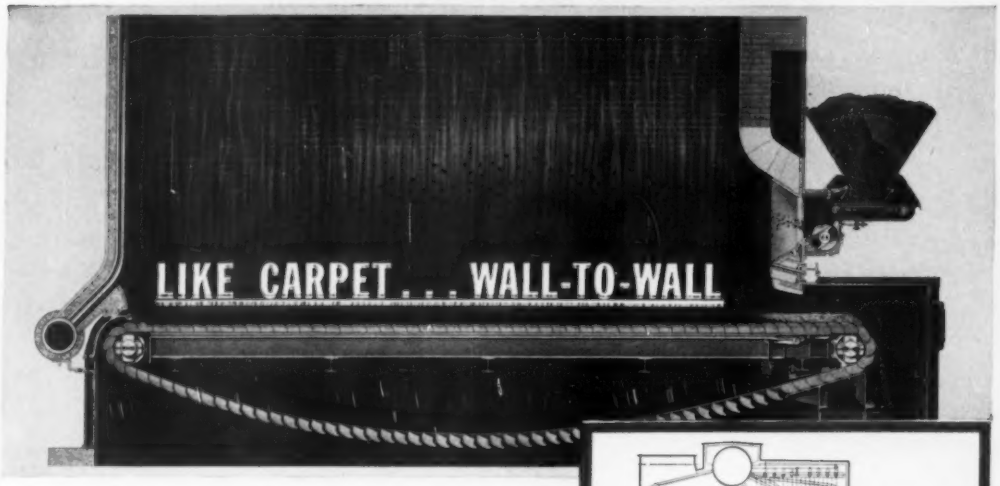
ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

CUTTING A BOILER IN TWO

to show why we dare call this stoker the

PERFECT SPREAD

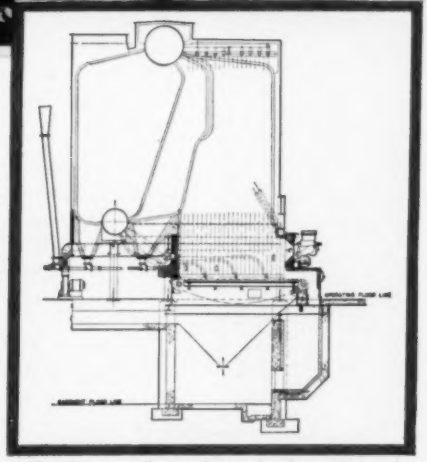


It's simple . . . it's economical and it
WON'T CLOG ON WET COAL

WHETHER THE COAL is bone dry or sopping wet, every AE conveyor feeder can deliver from 50 to 7,500 lbs. of coal per hour. The high traction principle employed – and its exclusive spiral overthrow rotor – deliver absolute uniformity of spread over the whole grate area, dependably, continually and without troublesome coal agitators.

Perfect Spread Stokers are built in a wide range of sizes, capacities and grate types . . . but *all* of them are equipped with American Engineering's exclusive conveyor feeder and rotor. This is one feeder that *won't clog on wet coal* . . . one whose true, continuous feeding is universally acknowledged as unexcelled.

If you need extra steam capacity, wish to replace obsolete equipment or abandon hand firing, mail coupon for full facts about Perfect Spread Stokers.



The above installation, designed to burn Ohio coal 11,600 B.T.U.s "as fired", 12.7% ash, 4.4% sul., with 2,000° F. – A.S.T.

AMERICAN ENGINEERING
COMPANY
PHILADELPHIA 25, PENNA.

AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

American Engineering Company
2408 Aramingo Ave., Philadelphia, Penna.

Gentlemen:- We are interested in getting top efficiency from both low and high ash coals. Please send us full information about Perfect Spread Stokers.

Name_____ Title_____
Company_____
Address_____
City_____ Zone_____ State_____

How to *INCREASE BOILER RATINGS*

with your present furnace and stack

Coppus-Dennis FANMIX Burners Give You More Heat with No Other Major Change in Equipment

Coppus-Dennis **FANMIX** Burners give you *perfect* mechanical mixing of fuel and air *at the burner outlet . . . instantaneous* ignition close to the burner . . . and *complete* combustion *without visible flame* when burning natural gas. No other burner combines these three advantages.

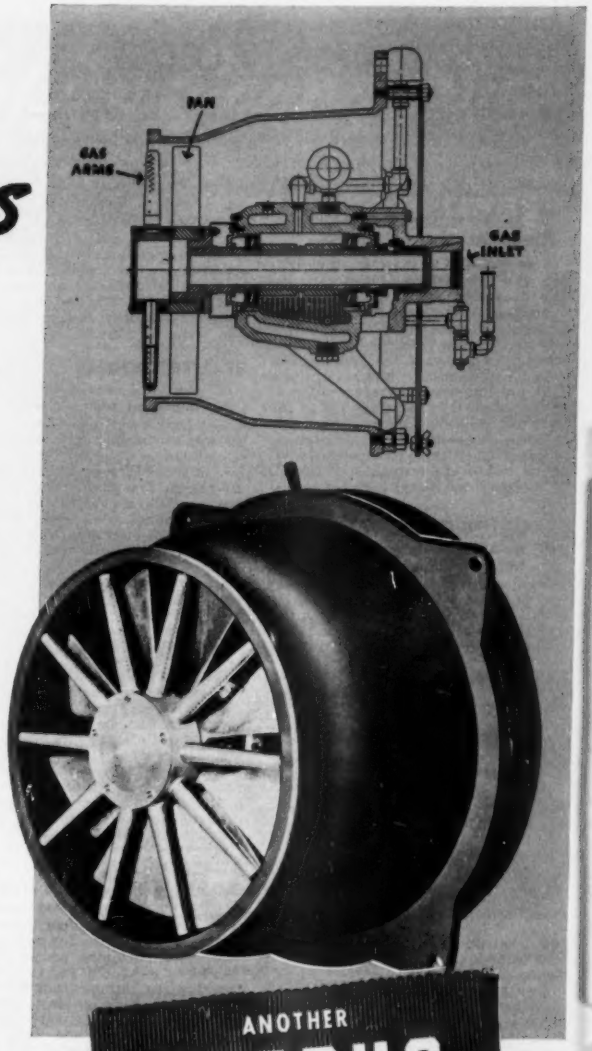
Because **FANMIX** delivers the *right* mixture of fuel and air *without blow-torch action*, all of your furnace space is used for combustion . . . *none for mixing*. That's why your present furnace can release more heat . . . why new installations can get more heat out of smaller furnace space.

Because **FANMIX** can be guaranteed to secure complete combustion of natural gas *with less than 5% excess air*, you get uniform "radiant heat" *without drifting hot spots*. That's why a **FANMIX**-fired furnace seldom varies in temperature more than 5% over its entire area.

WRITE FOR ALL THE FACTS

When you see in Bulletin 410–6 how fuel escaping from orifices in rotating driver arms rotates the fan to draw the correct proportion of air into the path of the fuel at right angles . . . how **FANMIX** creates its own forced draft, reduces stack requirements, prevents cracking of "wet" gas . . . how two **FANMIX** types handle either gas or oil or any combination of both — you'll understand why **FANMIX** Burners have such wide acceptance in oil refineries and power plants.

Send for the Coppus-Dennis **FANMIX** Bulletin 410–6. Coppus Engineering Corporation, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, and REFINERY CATALOG.



ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP.
168 Park Ave., Worcester 2, Mass.
Please send Bulletin 410–6 to:

Name .....

Company .....

Address .....

Equipment News

SUMMARIZED HERE are new products and improved ones . . . recent developments of leading manufacturers who will gladly supply further information at no cost. You may use the no-obligation, postage-free cards on pages 123–124 for your request. Just list the numbers of the items you'd like to know more about

1—DEALKALIZING PROCESS

Is designed to increase capacity of anion exchange resins

This dealkalizing equipment is announced as easily installed and simple to operate, as well as affording worthwhile savings over methods in which the exchange capacity of the resin is low due to the formation of blanketing gases which prevent complete regeneration of the resin bed. By raising the pH of the regenerant solution, this company offers a process designed not only to step up the capacity of the exchange bed, but also to improve the quality of the effluent. American Water Softener Co.

2—CONTINUOUS V PACKING

For 500 to 6000 psi, in types for high and low temperatures

Packing size is the only dimension that need be given when ordering Continuous-Vee Packing — the user cuts his own rings on the job to fit rod and stuffing box dimensions. The economical

new chevron-type packing comes in sizes from ¼ to 1 in., by $\frac{1}{16}$ in. increments, 25 ft per spiral.

Two types are available: No. 2005, constructed of asbestos cloth and neoprene, is for high temperature service on reciprocating steam or air rods, hot oil pumps. No. 2008, for lower temperatures, is made of cotton duck and neoprene. Its uses include hydraulic rams and outside packed plunger pumps, handling oil or water. Top and bottom adapters in continuous form are available for use with both styles. Mechanical Packing Div., Flexrock Co.

3—STEAM TRAP

Piston operated, for use where extra large capacities are needed

Being comparatively small and several times lighter in weight than many designs of piston-operated traps, the new Type SP has a 2 in. orifice with tremendous capacities, company reports. It combines company's four-operation principle of airvent, strainer, condensate discharge and check valve.

All moving parts of the trap are stainless steel including the piston plunger, piston liner and spring. The strainer is of heavy duty phosphor screen for pressures to 250 psi, and of stainless steel for higher pressures. This trap can be supplied with screwed connections 1½, 2, 2½ and 3 in., or with flanged connections ranging from 1½ to 5 in. Velan Engineering Co.

4—AFTER COOLER

Has been redesigned to provide increased cooling capacity

In the Aero After Cooler, for compressed air or gases, cooling is by evaporation of re-circulating water sprays on the surface of tubes through which compressed air passes. The greater capacity of the new models is gained by improved distribution of compressed air in the machine and increased evaporating surface. Tube sizes have been increased to reduce friction. The equipment is designed for installation outdoors to provide cleaner compressed air and save indoor space. An automatic control for shutting off freezing cold air from the spray chamber is incorporated to prevent freezing in winter.

Since its cooling medium is air at the atmospheric wet bulb temperature — cooler than the average summer temperature of surface cooling water — the Aero After Coolers use much less cooling water than many types of after coolers, company points out. And since the compressed air is cooled below atmospheric dry bulb temperature it prevents condensation in compressed air lines, it is noted. Niagara Blower Co.

5—CIRCUIT BREAKERS

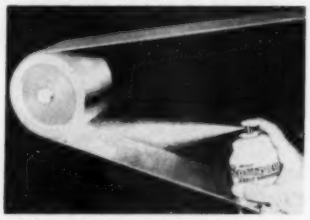
Newly designed line of oil circuit breakers for outdoor installation

This new line of outdoor power circuit breakers for distribution and sub-transmission applications comes in ratings of 14.4 to 46 kv, 600 and 1200 amp, and interrupting ratings from 250 through 1500 mva. New oil-blast interrupters are used to reduce oil carbonization by interrupting fault and load currents with short arc lengths and low arc energy, according to the manufacturer. Silver-molybdenum contact surfaces give low resistance and a minimum of corrosion, and the open supporting frame offers convenient access to interrupters. General Electric Co.

7—BELT DRESSING

Is packed in handy spray container for easy application

Grako Sprazon is the liquid belt dressing formerly known as Grako R Clear, now marketed in a 12-oz spray container. Depressing valve with forefinger directs a powerful spray at belts and pulley



faces, and the package holds enough liquid to treat approximately 350 sq ft.

The spray is directed at smaller pulley face where slippage is most likely to occur. The fine mist of dressing is transferred evenly to the belt and quickly absorbed by the leather fibres. A leather preservative, Grazon acts to keep belts pliable and resilient and to impart a high coefficient of friction to prevent slipping. Graton & Knight Co.

8—MOLDED RUBBER HOSE

Comes in five basic types, color coded as to application

In announcing the consolidation of its molded rubber hose line from 18 to five types, this manufacturer says the new line offers as much versatility as the former line because of improved performance gained from new components. These include the use of rayon braids of high tensile strength, and new tubes and covers of both natural and synthetic rubber.

Versaflex, with a red cover, leads in breadth of range and applicability. It is designed to handle pressures to 800 psi, and its oil-resistant tubes and covers permit carrying of butane and propane. Versicon is a brown-covered hose for most industrial uses at working pressures to 300 psi. Green-covered Aquair is intended principally for con-

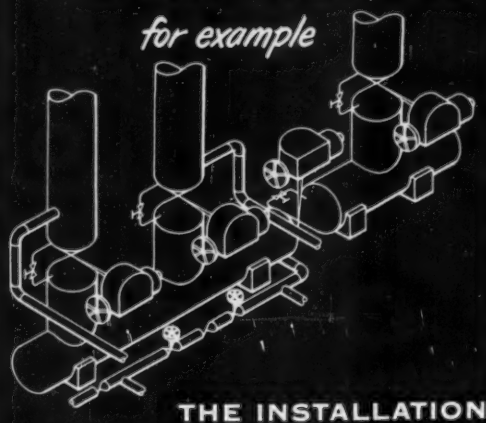
6—JACKETING

Is easily applied to outside insulated lines

This weatherproof jacketing is made of corrugated aluminum. A two-man crew can apply it with only a pair of pliers and a screwdriver, manufacturer says; no special shop work or roll forming is necessary. The jacketing is suggested for use on outside insulated lines in power plants, refineries and chemical plants. The Childers Mfg. Co.

Are Your Valves Giving this Low-cost Service?

...on Main Steam Lines, for example



THE INSTALLATION

Crane 900-Pound Pressure-Seal Bonnet Gate Valves, motor-operated, on main steam header, in a mid-western public utility power station.

VALVE SERVICE RATINGS

FEATURES:	Pressure-Seal Bonnet Joint and Flexible Wedge Disc
SUITABILITY:	Latest High Pressure Service Design
MAINTENANCE COST:	None in 4 years—except lubrication
SERVICE LIFE:	Should outlast any bolted bonnet valve
OPERATING RESULTS:	No forced outages for valve repairs
PRICE:	In line for modern, high quality valves
AVAILABILITY:	Regular item in Crane line

THE HISTORY

This battery of 10-inch Crane Pressure-Seal Bonnet Gates has been in operation about 4 years on 825° F. —825 psi steam. Their performance is rated in direct comparison with bolted-bonnet valves, same size and pressure class, on identical service in the station.

While installed some years earlier, the bolted-bonnet valve records show considerable repairs for seat leakage, and difficulty in keeping bonnet joints tight. The plant also reports trouble with discs sticking shut.

In contrast, Crane Pressure-Seal Valves have given satisfaction since installed. Seats and bonnet joints alike remain leak free, tight as new. Valve operation is smooth and positive.

THE VALVE

Here is simplified development of the pressure-seal bonnet principle. Crane Pressure-Seal Gate Valves eliminate bonnet joint leakage and maintenance with a one-piece seal ring design, using no gaskets or auxiliary parts. Readily accessible, the joint needs no special tools for dismantling. Self-adjusting to temperature effects, Crane flexible wedge disc prevents sticking; takes minimum torque to open, hot or cold. See your Crane Representative or your Crane Catalog for full data on these modern valves in 600, 900 and 1500-pound pressure classes.

The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

ducting water, air and oxygen at pressures to 200 psi. Utility is a black-covered general purpose hose for pressures to 125 psi. Powerflex, specifically designed for superheated steam at pressures to 200 psi, is reinforced with steel wire braids in addition to asbestos wire yarn. Thermoid Corp.

9—WATER CONDITIONER

Is offered for use in heat exchangers and condensers

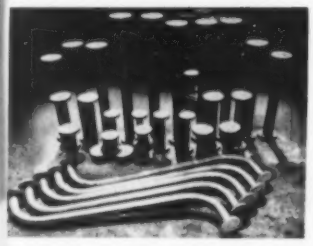
Pur-O-San Extra is described as readily soluble and capable of providing full protection regardless of the characteristics of the water used. Manufacturer says best results are obtained by first circulating it through the system to remove scale, sludge and other soft deposits. This, it is pointed out, will descale the heat exchanger without dismantling, and is faster and safer than manual methods. Regular use of Pur-O-San Extra is suggested to keep tubes free and prevent over-heating, leaking.

Said to be non-toxic, non-volatile and heat stable, the new product combats corrosive attack by adsorbing at metal surfaces in the form of a thin, impervious film to prevent contact between corrosive elements and metals, and retard thinning of tubes. The Pur-O-San Co.

10—RUBBER LINING

Is designed to prevent failures in pipe bends, fittings

Rubber lining and covering for pipe, fittings and process equipment is claimed to permit new applications with reduced maintenance costs, protected equipment investment, conserved space and prolonged useful life. According to manufacturer, special designs of bent pipe and shapes can be lined with rubber



without risk of processing failure, and it is possible to apply lining to three 90 deg bends in a single length of pipe as small as 4-in. ID. The lining gives a smooth interior surface, and rubber-material bond has high strength and resistance to aging. Inspection of entire surface lined or covered with rubber is made with 40,000-v test equipment. A report on case histories will be supplied on request. La Favorite Rubber Mfg. Co.

11—GAGE SNUBBERS

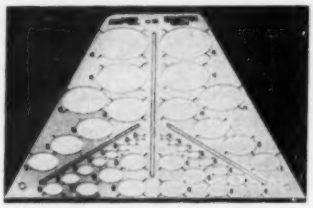
Of stainless steel, are redesigned for high pressure service

These snubbers, which utilize a porous stainless steel disc for damping pulsating pressures, are made in two standard sizes, ¼- and ½-in. SPT. The stainless steel bodies are rated at 20,000 psi operating pressure, and the brass bodies at 15,000 psi. The snubbers can be used as filters or as orifices to filter. Or they may be used to maintain small rates of flow. Equipoise Controls, Inc.

12—ISOMETRIC TEMPLATE

Features slot arrangement to speed exploded drawings

A new isometric template, No. 123, has a slot arrangement which makes it possible to draw all three axes without turning the template. Only time it has



to be turned, says the manufacturer, is when ellipses in a different elevation are required. Template contains 38 ellipses from 1/16 to 1 9/16 in. Made of 0.040 plastic, all cut-outs on template are machine milled with pencil allowance for accuracy. RapiDesign, Inc.

13—PUSH VALVE

Is self closing; for manual control of flow in gas and air lines

This new self-closing push valve for manual control of an intermittent flow is designed so that no leakage takes place through valve or around valve stem. It is opened by pressing a knob on stem, valve closes automatically when knob is released. Neoprene O-rings are used to prevent leakage, and are readily accessible. Breakdown tests showed no leakage after 1,000,000 cycles of operation, according to manufacturer. Applications include use with hydrostatic gages requiring manually-controlled blast of air, single- and multiple-pressure test stands. Discharge rate, for both in-the-line and panel mounted valves, is 25 to 30 c/m at pressure drop of 100 psi. King Engineering Corp.

14—PORTABLE PYROMETER

Is convenient unit for checking on diesel engine temperatures

The new Model 4-321 is designed for installations where no permanently mounted pyrometer is available. The thermocouples can be installed in each cylinder and in the main exhaust line, and temperatures can then be checked at any time by inserting the pyrometer prongs into the corresponding receptacles in the terminal head of the thermocouple. Bulletin P1247 describes the new pyrometer. The Birstol Co.

Want more details on these new products? Use the post cards provided on page 123

15—RATCHET REPAIR KITS

Contain replacement parts and special spanner wrench

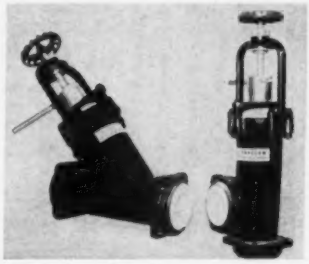
Offering a complete assortment of replacement parts, these kits are for company's ⅜-in. and ½ in. square drive Superratchets. The wrench included fits the retaining ring (gland), the only part requiring a tool for assembly or disassembly. Printed instructions are also provided. J. H. Williams & Co.

16—ARMORED PORCELAIN

For acid work; or where corrosion or contamination are ruled out

The Tufclad line of solid white porcelain valves, pipe and fittings has an armor applied in the form of multiple layers of heavy fiberglass woven cloth impregnated with a modified phenolic resin of high adhesive strength for bonding to porcelain and between layers of cloth. Black in color, the oven-cured shell covers the procelain.

This resilient armor shell serves to cushion against impact and insulate against thermal shock. A more important advantage cited is that the



shell is homogenous and tough, capable of holding operating line pressures against gross leakage even if the porcelain is cracked or broken. Telltale leakage will signal damage, manufacturer points out, but safety to personnel and product are assured by at least temporary control of lines in case of an accident. Lapp Insulator Co.

17—SYNCLINAL FILTERS

Are now available for water filtration; line or sump types

This company's synclinal filters, widely used on low pressure oil recirculating systems are now being produced for filtering water. The sump type is available in capacities from 5 to 100 gpm and the line type from 5 to 50 gpm, with Monel mesh sizes ranging from a coarse 30 to fine 200. No changes have been made in basic design. Line types operate in any position and may be serviced without disturbing pipe connections. Both types may be disassembled and cleaned on the spot. Complete engineering data is available on request. Marvel Engineering Co.

18—PROTECTIVE RELAY

With inverse or very inverse time characteristics; in three ranges

Used principally for protection of transmission and distribution lines, the new CO Relays are slow-speed overcurrent type available in one of three ranges: 0.5 to 2.5 amp, 2 to 6 amp, or 4 to 12 amp. Accuracy, flexibility and reliability are announced as important features.

Accurate timing is provided by adjustable magnetic plugs in the E element electromagnet. Accurate pick-up at tap value of current for disc positions is provided by two independent adjust-

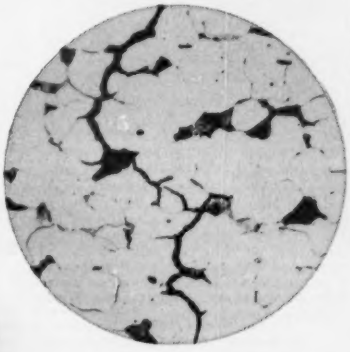
TECHNICAL SERVICE for your plant water problems

Hall Laboratories' specialist studies a specimen on a metallographic microscope. This modern instrument is an example of the equipment Hall Laboratories utilizes in seeking the answers to your plant water problems.

The metallographer focusing this precision microscope-camera is taking one step toward solving a plant water problem. The structure of damaged metal often is an important factor in determining the cause of failure or poor performance. Stress-corrosion, caustic embrittlement and overheating can be detected by this method. The evidence, in conjunction with Hall Laboratories' other modern techniques, helps clients solve industrial water problems.

You can profit by Hall Laboratories' wide experience and modern equipment. Every phase of the use and disposal of industrial water is included in the scope of Hall Service and facilities for all industries —metal, paper, power, chemical, for example.

For information pertaining to your particular Industrial Water problems, write, wire, or call Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pennsylvania.



Photomicrograph of the typical intergranular cracking of caustic embrittlement. The metal was damaged by concentration of alkaline boiler water at a leaky tube end.

HALL LABORATORIES, INC.

ments. Accurate adjustment of damping torque of the permanent magnet is done by keeper screw without moving magnet.

The relay can be changed in the field from one time characteristic to the other. It is mechanically and electrically interchangeable with previous type CO Relay. Metal-to-metal contact between tap terminal and tap plate, as provided by the positive action tap block with "self-positioning" taps, makes the contact system reliable, company states. The new relay is available in either standard projection or Flexitest case. Westinghouse Electric Corp.

19—BALL VALVE

Is designed for working pressures up to 3000 psi

Positive shutoff of this new ¼-in. valve is provided by the stainless steel ball closing into a machined, conical seat. Retained at the end of a long-stroke stem, the ball is free-rolling. Alignment of ball to seat is piloted by forged steel, union-type bonnet. Packing in stainless steel gland is preformed, graphited asbestos with a plastic binder. Straight-through and angle-types with two to four connections are available. Valve is useful on meter manifolds, gage lines and seal chambers, for liquid, gas and steam service. The Foxboro Co.

20—CENTRIFUGAL FAN

For uses requiring high efficiency, lower noise level

Designed especially for industry, power and commercial building needs, this new type non-overloading fan ranges in wheel sizes from 40¼- to 108¾- in. dia and is

declared capable of delivering volumes up to 600,000 cfm. The new airfoil blade design, along with simultaneous aerodynamic changes in inlet and casing, has boosted mechanical efficiency at peak to 92 per cent, company states, and compared with previous models, there is a reduction of 5 decibels in the noise intensity level. Sturtevant Div., Westinghouse Electric Corp.

21—DRAFTING DEVICES

Are low-cost units for use in preparation of ruled forms

With the Paraliner Forms Ruler, parallel lines, either horizontal, vertical or diagonal, can be spaced from a thousandth part of an inch to 1 in. or more on any size sheet. A controlled index wheel on the Paraliner board is set against a measuring scale at the desired space. Then step-by-step, the ruling edge is moved forward with thumb and forefinger — letting the operator draw the lines already set by the index.

The Paraliner Line-Up and Light-Table is an all-steel frame table with the Paraliner Ruler built into a glass board which lights up from the inside. Michael Lith Co.

Use post cards on page 123 to ask for more information on any of these products

22—POWER UNITS

Multi-speed type, for heavier horsepower applications

Models 2004, 3004 and 5004 Transmissions are available in ratings up to 60 hp, and described as ideal for use wherever it is necessary to vary the turning speed of electrically-driven equipment or machinery.

All of these transmissions are available in four speeds, with a selection of different speed ratios; some models can be supplied with six and nine speeds. A practical feature is the availability of two types of mounting brackets — one is a vertical arrangement with motor mounted on a hinged plate over the transmission; in the other type of mounting the motor is mounted either in front of or behind the transmission. Turner Machinery Co.

23—INSERT COUPLINGS

For sharp turns or take-offs from flexible plastic pipelines

With these new insert-type ell and tee couplings, one fitting makes a connection which formerly required the use of three or four, according to manufacturer, and the new fittings are joined in the same manner as previously used insert couplings. Sections of pipe can be cut to required length with a hand saw and the fitting inserted. Stainless steel clamps are tightened over the pipe and fitting to draw the pipe down onto the serrations of the insert. Only tools needed are saw and screwdriver, it is pointed out, and the job takes less than 2 min.

When flexible plastic pipe is to be joined to a metal fixture or a previously installed metallic system, an insert adapter is used. Carlon Products Corp.

24—VARIABLE SPEED MOTOR

Provides speeds in a 10:1 ratio, with range from 4 to 10,000 rpm

A new development in single phase variable speed motors in fractional horsepower is the new Type VA-C, a modification of company's Type VA Varidrive. The compact motor permits use of 110 or 220 v and is made in ¼, ½, ½ and ¾ hp. By turning a control dial, the motor's speed can be changed to a desired speed without stopping, eliminating need for an external speed changing device. Bulletin 1601 gives full details. U. S. Electrical Motors Inc.

25—V-BELT SHEAVES

For machinery drives, are molded from a new type of fibrous material

Compolene, the material of which these sheaves are made, is molded to close tolerances under high pressure. It possesses a hard wearing surface said to be unaffected by moisture, oil, temperature, and to resist rust and corrosion. It is similar to the material used in pressure-molded gears.

The sheaves are stocked in sizes from 2 to 6 in. OD, in gradations of ½ in. Bore sizes are ½, ⅝ and ¾ in., with or without keyways. W. C. Products, Inc.

26—SAFETY DEVICE

Is a simple mechanism designed to lock valves open

Developed to eliminate the risk of someone closing a valve at the wrong time, the Lock-Open can be applied to company's forged steel stop valves in the 1-, 1¼-, 1½- and 2-in. sizes in all pressure classes to ASA 2500 lb sp. The device consists of a lock, indicating bracket with red pointer and guiding bracket. Welded to the valve bonnet,

the guiding bracket remains stationary. The indicating bracket fits under the handwheel on the stem, and the pointer moves up or down as the handwheel is turned to open or close the valve — showing position of the valve.

At the position where the indicating bracket reaches the spot marked "O" (open) a hole is drilled through both brackets so a lock can be inserted and snapped shut. You can't close the valve without the key, company points out.

Company's Univalve equipped with the Lock-Open is said to conform to Paragraph P-293 of the ASME Construction Code for power boilers suggesting its application as a shut-off valve in the pipe connection between a boiler and water column. Edward Valves, Inc.

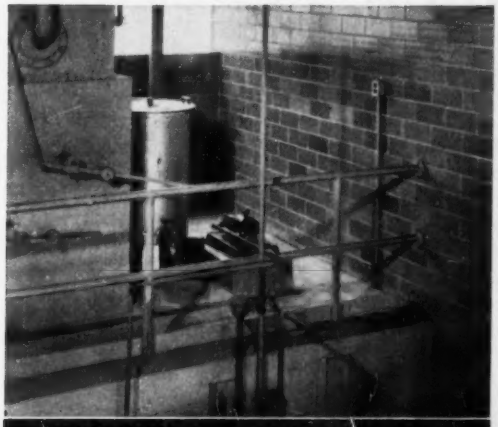
27—ELECTRIC GENERATORS

Engine-driven, are available with or without engine

The belted construction of these 300 to 10,000 w generators is designed to make mounting or dismounting of the engine a simple matter. All that is necessary to remove the engine is to unbolt it from its mounting base and drop off the V belt; then it is available for such other uses as driving compressors or pumps. Generator, engine-generator mounting base, belt guard, generator and engine pulleys and V belt are sold as a package, letting user buy it without engine, if so desired. The engine mounting base is drilled to receive several popular makes of engines. Wincharger Corp.

Dearborn provides water conditioning

for GREATER Pittsburgh airport



BOILER HOUSE—Dearborn 53HA Tank and Type "N" Pump for continuous feeding of Formula 702* to boiler feed lines to eliminate return line corrosion.

HOT AND CHILLED WATER RETURN LINES—Fiberglas covered with NO-OX-IDized Wrapper No. 4 completely insulates piping.

Larger than La Guardia Field and Washington's National Airport combined, the new Greater Pittsburgh Airport is now serving air-minded America. Architectural innovations in the design of the seven story terminal building will serve as an airport model for years to come. Dearborn is proud of its part, the development of a water treatment program and pipeline protection for costly heating and air conditioning equipment installed in this magnificent masterpiece.

Specialists in Industrial Water Treatment and Rust Prevention since 1887, Dearborn gives you a *complete* service (1) analysis of your requirements (2) the correct formulas and equipment to apply them (3) proper test control procedure. Take advantage of Dearborn experience on your next job . . . call in a Dearborn Engineer for consultation. Bulletins sent on request.

DEARBORN CHEMICAL COMPANY

Merchandise Mart Plaza • Chicago 54, Illinois

*U. S. PAT. 2400343

FLUOR COUNTERFLO AIR CONDITIONING TOWER—Water treated with Formula 846 eliminates scale and corrosion. Formula 517 is used in the closed section for the same purpose.

Dearborn Chemical Company, Dept. PG
Merchandise Mart Plaza, Chicago 54, Ill.

- ☐ Send me Bulletin 5000 on Dearborn Industrial Water Treatment.
- ☐ Bulletin on NO-OX-ID Rust Preventives.
- ☐ Please have a Dearborn Sales Engineer call.

Name.....

Company.....

Position.....

Address.....

City.....*Zone*.....*State*.....

Dearborn

TRADE MARK REGISTERED

THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

HOW DO YOU CHOOSE BETTER BOILER TUBES?

All boiler tubes are made to the same specifications to do the same jobs, no matter what mill supplies them. In the warehouse, they all look pretty much the same. Surface comparison rarely shows the difference. That is because only *time* can truly test the worthiness of a tube in a boiler—time and the ravages of heat, corrosion and oxidation. Look for the answer down in the basements of apartment houses, or hospitals, or schools, or office buildings, or anywhere else you'd expect to find good boilers, made by fine craftsmen, performing efficient and faithful service over the years. Almost anywhere you look, you'll find the most reliable boilers are equipped with B&W boiler tubes.

Say B&W before you say WELDED BOILER TUBES—for Service-Proved Dependability. For three-quarters of a century, B&W has been directly concerned with developing and applying boiler tubes for pressure requirements. The application of this extensive knowledge and experience results naturally in the production of superior boiler tubes.

B&W dependability is proved by time and endorsed by hundreds of customers who keep coming back for more . . . B&W WELDED BOILER TUBES.

B&W SEAMLESS and WELDED TUBES

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION

General Offices & Plants
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing
Sales Offices: Beaver Falls, Pa. • Boston 16, Mass. • Chicago 3, Ill. • Cleveland 14, Ohio • Denver 1, Colo. • Detroit 26, Mich. • Houston 19, Texas • Los Angeles 17, Cal. • New York 16, N. Y. • Philadelphia 2, Pa. • St. Louis 1, Mo. • San Francisco 3, Cal. • Syracuse 2, N. Y. • Toronto, Ontario • Tulsa 3, Okla.

TA-1694C

POWERHOUSE PUMPS

Use This Pump Laboratory

TO STUDY ACTUAL SUCTION CONDITIONS BEFORE CONSTRUCTION STARTS

CORRECTING PUMP SUCTION CONDITIONS after your powerhouse is built can be mighty expensive. You can avoid this danger by testing your suction bay design in this Allis-Chalmers test laboratory.

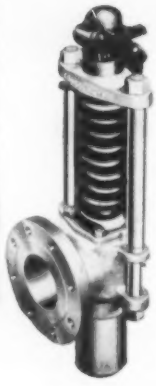
This unit will duplicate the shape and water flow conditions of your suction bay and show you just how your circulating pumps will operate after installation. You can experiment with the shape and size of the suction bay, test various positions for foundations and pilings, check the effect of adding more pumps at a later date, plot operating characteristics at various loads; in fact, duplicate almost any suction condition that you may encounter in your plant.

Available to Consulting Engineers and Power Plant Operators

The pump testing facilities of the Allis-Chalmers research laboratories are available at the West Allis, Wisconsin, Works to all consulting engineers, utilities and power plant operators concerned with large pump operation. If this pump testing laboratory can help you, call your Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wis.

A-3782

ALLIS-CHALMERS



Safety valves with greater discharge capacity and shorter blowdown are essential on high-pressure, high-temperature steam generating equipment. Consolidated *Maxiflow* Safety Valves release the greatest amount of steam that can flow through a given size inlet with imposed entrance conditions.

They provide other functional advantages. Tightness is permanent: thermodisc seating eliminates distortion due to thermal stresses—temperature differentials are quickly equalized. The forged steel through bushing has precision-machined surfaces for better steam flow, greater resistance to erosion, corrosion. Blowdown can be controlled with the externally adjustable "micrometer" trim ring while the valve is under pressure. By combining proper compensation with metals of low coefficients of expansion, the popping point is retained.

Get complete safety and service feature data; also capacity tables. Write for Consolidated *Maxiflow* Safety Valve Bulletin 707.

CONSOLIDATED SAFETY VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.
MAKERS OF 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES. BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

GIVE OXIDATION and DEPOSITS in turbine lubricating systems

the GULF ONE-TWO

1. CLEAN IT UP WITH GULF TURBINE FLUSHING OIL

Removes grease-type slushing compounds. Carries away harmful abrasives. Protects against rust.

2. KEEP IT CLEAN WITH GULFCREST OIL

Maintains low neutralization number. Lasts indefinitely. Prevents rust on all oil-bathed surfaces.

Ask a Gulf Lubrication Engineer for additional information. Write, wire, or phone today. Gulf Oil Corporation · Gulf Refining Company, Pittsburgh 30, Pennsylvania.

GULF INDUSTRIAL LUBRICATION

CONCENTROL STOPS FOAMING

BEFORE

Laboratory demonstration shows foaming of highly alkaline solution in test cylinder.

This laboratory demonstration shows — as do scores of successful installations — that Bird-Archer's Concentrol is a highly effective anti-foam agent. It quickly stabilizes alkaline boiler water . . . eliminates foaming action and carryover. With Concentrol, you can forget about bouncing water gages. You get good quality dry steam every hour of every day.

Concentrol is available in liquid, powdered or briquette forms. Special Concentrol formulations are also available containing other commonly used boiler water treatment chemicals such as tannins, phosphates, alkalies, sulfite, etc.

See for yourself how economical Concentrol helps improve steam quality. Your Bird-Archer representative will demonstrate Concentrol in your plant . . . make specific recommendations for its use. Consult him, or write direct to Bird-Archer, outlining the details of your boiler operation.

FREE DATA SHEET AVAILABLE

HOW CONCENTROL WORKS

Concentrol works by effecting a rapid change in surface tension of steam bubbles which permit coalescence of small steam bubbles into bubbles of larger sizes. This results in the formation of unstable bubble films which break readily upon reaching the steam disengaging surface of the boiler water. This does away with foam build-up and subsequent carryover.

BIRD · ARCHER

WATER TREATMENT

THE BIRD-ARCHER COMPANY

4337 North American St., Philadelphia 40, Pa.

NEW YORK · CHICAGO

IN CANADA

The Bird-Archer Co., Limited

Cobourg, Ontario

IN MEXICO

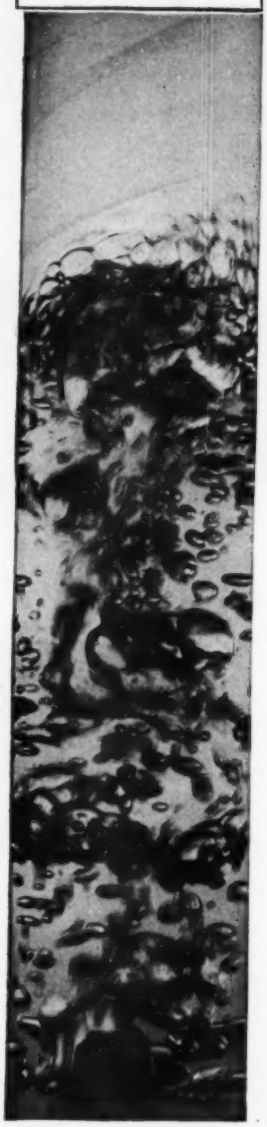
Calderas y Accesorios, S. A.

Amsterdam 291, Mexico D. F.

BA 162

AFTER

Same solution after addition of 12 ppm of Concentrol Anti-foam. Constant heat conditions were maintained during test.



What's the $ Connection?

If there's a furnace operation in your setup . . . there's a mighty big connection between the CITIES SERVICE HEAT PROVER and your profit and loss picture.

Heat Prover—not an instrument you buy, but a service we supply—helps to increase furnace productivity through these five unique advantages:

1. **Rapid, continuous sampling.**
2. **Simultaneous reading of oxygen and combustibles.**
3. **Direct measurement of oxygen and combustibles.**
4. **Easy portability.**
5. **No maintenance; no re-calibration.**

ACCURATE, FAST CITIES SERVICE HEAT PROVER ANALYSIS CAN PUT THE FINGER ON WASTE IN YOUR FURNACE OPERATION. It's being widely used in a great variety of industries. Find out how Heat Prover can serve you. Write Cities Service Oil Company, Dept. H23, Sixty Wall Tower, New York City 5.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

These Industrial of Detroit

OF VARIOUS TYPES AND CAPACITIES ARE TYPICAL OF THOUSANDS OF CUSTOMERS. SUCH UNIVERSAL ACCEPTANCE... AND THE LARGE NUMBER OF REPEAT ORDERS ... ARE OVERWHELMING EVIDENCE OF SATISFACTION.

Aluminum Co. of America—9 plants
Allied Chemical & Dye Corp.—4 plants
Abitibi Power & Paper Co. Ltd.—2 plants
Amalgamated Sugar Co.—3 plants
American Crystal Sugar Co.—3 plants
American Steel Foundries
American Tobacco Co.—2 plants
Armour & Co.—4 plants
The Borden Co.—28 plants
Burroughs Adding Mach. Co.—2 plants
Cannon Mills Inc.—10 plants
The Carborundum Co.—3 plants
J. I. Case Co.—5 plants
Chesapeake & Ohio Ry. Co.—7 plants
C. B. & Q. R. R. Co.—4 plants
Chicago & Northwestern R. R.—3 plants
Chrysler Corporation—12 plants
Columbian Carbon Co.—3 plants
Peter Cooper Corporations—4 plants
Crane Co.
Avco Mfg. Corp.
Crosley Division—2 plants
Crosse & Blackwell Co.—2 plants
Crucible Steel Co. of America—2 plants
Cudahy Bros. Co.
Deere & Co.—6 plants
E. I. Dupont de Nemours & Co.—9 plants
The Electric Autolite Co.—14 plants
The Falk Corp.
Firestone Tire & Rubber Co.—6 plants
General Electric Co.—6 plants
General Foods Corp.—3 plants
General Motors Corporation—37 plants
Goodyear Tire & Rubber Co.
Great Lakes Sugar Co.—3 plants
Great Western Sugar Co.—3 plants
Hercules Powder Co.—4 plants
Homestake Mining Co.—9 plants
International Harvester Co.—2 plants
International Shoe Co.—17 plants
Jones & Laughlin Steel Corp.
Spencer Kellog & Sons Inc.—6 plants
Koppers Co. Inc.—2 plants
Lever Bros. Ltd.
Libby, McNeill & Libby—3 plants
Libbey-Owens-Ford Glass Co.—3 plants
Liggett & Meyers Tobacco Co.—2 plants
Eli Lilly & Co.—2 plants
Marshall Field & Co.—3 plants
Michigan Sugar Co.—6 plants
Minnesota Mining & Mfg. Co.—4 plants
Minneapolis-Moline Co.—2 plants
Monsanto Chemical Co.—3 plants
Nash-Kelvinator Corp.—2 plants
National Dairy Prod. Corp.—12 plants
Nestle Co., Inc.—4 plants
New York Central System—14 plants
Pacific Mills—3 plants
Pittsburgh Plate Glass Co.—3 plants
Pullman Inc.—5 plants

WHY NOT LET US REDUCE YOUR STEAM COST?

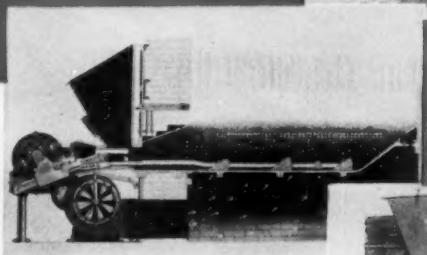
An informal discussion with one of our Engineers will cost you nothing and might save you a lot. Write us today.

DETROIT SINCE 1898 STOKERS

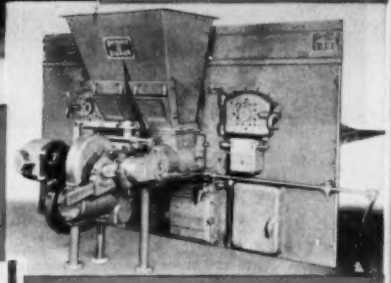
Users Stokers

THERE IS A TYPE AND SIZE OF DETROIT STOKER FOR EVERY INDUSTRIAL NEED

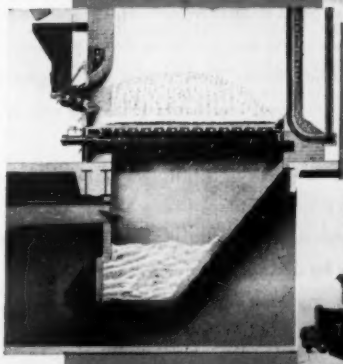
LOSTOKER—Single retort underfeed, with Adjustable Feed—great coal saver for small boilers. ▶



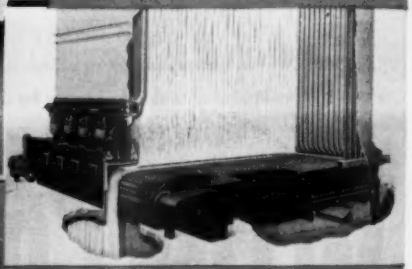
UNISTOKER with Adjustable Feed. Compact unit type. Fan and motor, conveniently mounted at front. Automatically controlled.



DOUBLE RETORT STOKER—A Multiple retort, side cleaning stoker with Adjustable coal feed control. ▶



ROTOSTOKER—Spreader stoker with overthrow rotors—Burns wide range of fuel—Handles fluctuating loads—Dumping, or stationary grate types. ◀



ROTOGRATE STOKER—Improved spreader stoker with grates that continuously discharge the ash at the front—Permits high burning rates per square foot of grate.

Quaker Oats Co.
Ralston Purina Co.—11 plants
Republic Steel Corp.—2 plants
Rochester & Pittsburgh Coal Co.
Shepard Niles Crane & Hoist Corp.
Square D Co.
Stromberg-Carlson Co.
The Studebaker Corp.—3 plants
Swift & Co.—18 plants
Tennessee Coal, Iron & R. R. Co.
Tennessee Eastman Co.
Union Carbide & Carbon—3 plants
United States Gypsum Co.—4 plants
United States Leather Co.—5 plants
Walworth Co.—2 plants
W. Va. Pulp & Paper Co.—2 plants
Western Electric Co. Inc.
Wilson & Co.—8 plants
Worthington Pump—2 plants
Rudolph Wurlitzer Co.—2 plants
Wyman Gordon Co.
Willys-Overland Motors, Inc.

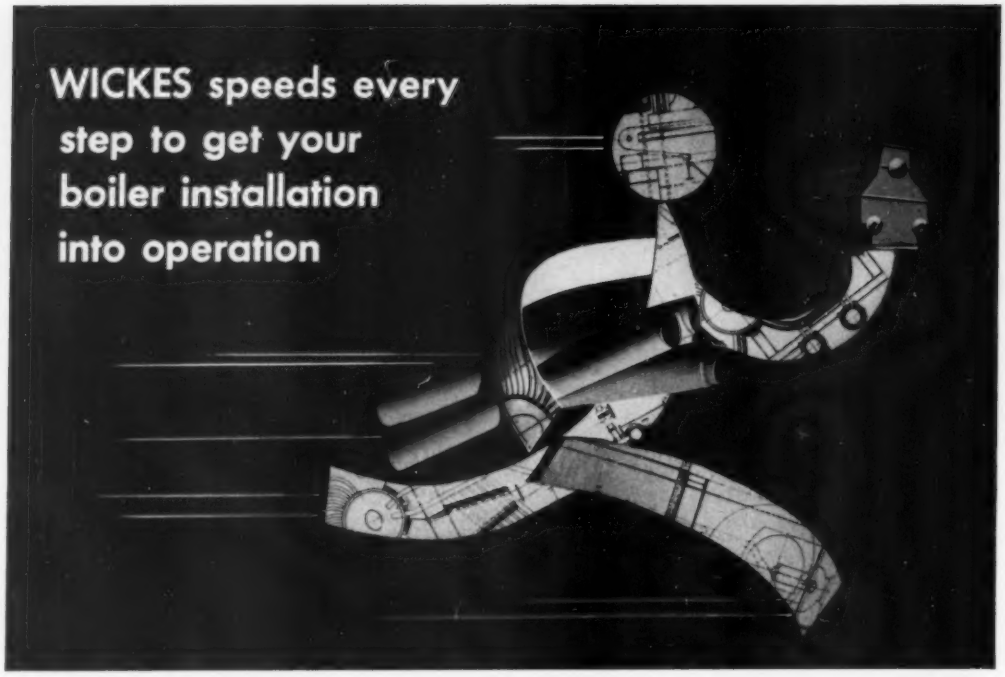
Automotive Manufacturing—
112 plants

DETROIT STOKER COMPANY

GENERAL MOTORS BLDG., DETROIT 2, MICH.

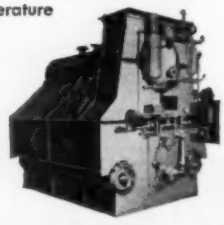
Works at Monroe, Mich. • District Offices in Principal Cities

WICKES speeds every step to get your boiler installation into operation



From the moment you place your order for a Wickes boiler, Wickes engineers and production men swing into action. They know that when you want a new steam generator, you want it fast and they rush production to get it to you. Wickes does the whole job, too—from the time the first drawings are made right up to the day you raise steam pressure. They build the boiler and they handle every last detail of installation. Then Wickes service takes over and continues for the life of the boiler. Wickes sales engineers and maintenance men in most principal cities are ready to serve you day or night.

Wickes can fill your requirements for steam generators up to 250,000 lbs. per hour and 1000 psi.—all types of multiple drum boilers adaptable to any standard method of firing. Wickes boilers operate at a high degree of efficiency and owners' records show modest maintenance costs. Write today for descriptive literature or consult your nearest Wickes representative.



WICKES

140

THE WICKES BOILER COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

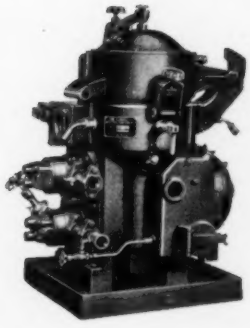
RECOGNIZED QUALITY SINCE 1854 **• SALES OFFICES: Atlanta • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit • Greensboro, N. C. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Pittsburgh • Portland, Ore. • Saginaw • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D. C.**

DE LAVAL CENTRIFUGING COSTS LESS THAN "DOWN TIME"

The cost of a De Laval Centrifugal Oil Purifier of any given size is only a fraction of the cost of the prime mover it protects. There's no denying it, the comparatively modest investment represented by a De Laval Oil Purifier is far outweighed by the cost of even one serious shutdown. A De Laval machine is truly inexpensive insurance.

A De Laval Purifier instantaneously removes from lube oil, all water, dirt or sludge by means of centrifugal force, keeping the oil clean and safe to use over and over again.

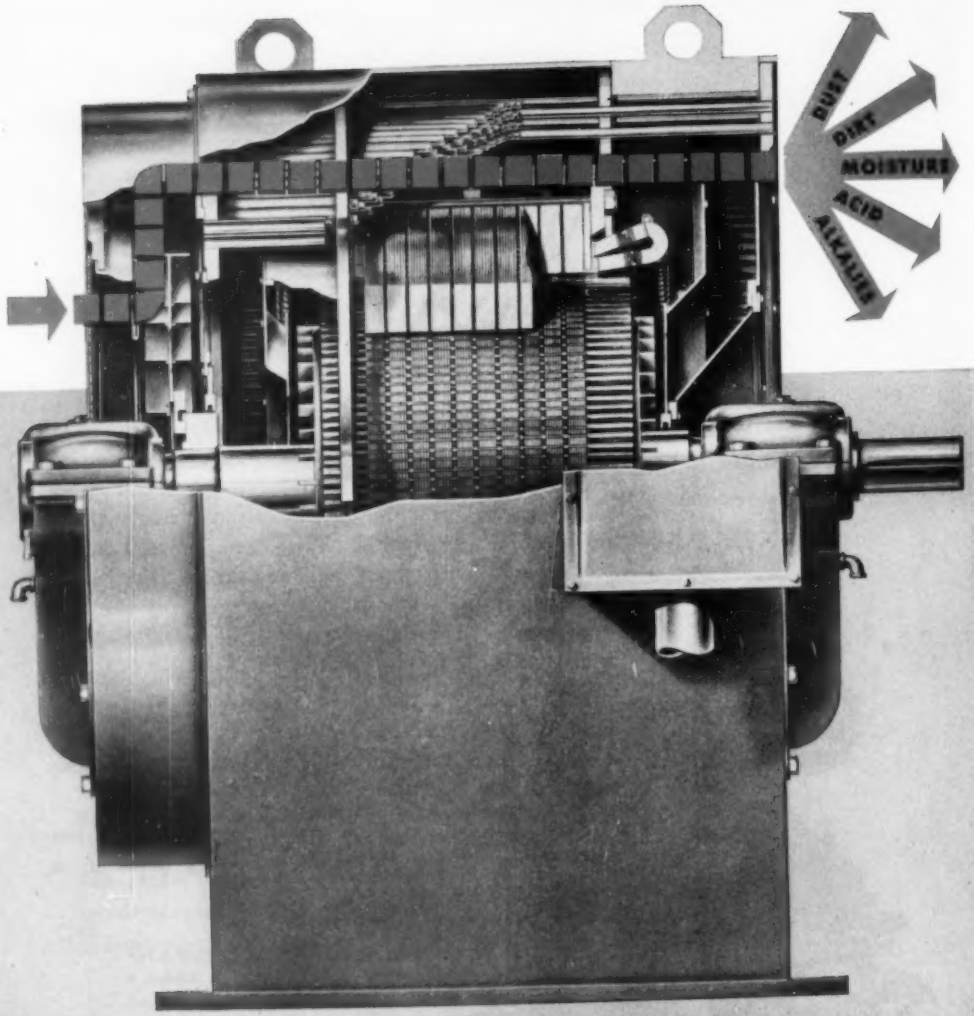
De Laval Oil Purifiers protect power units from ***both*** causes of lubrication failure—they never do a "half-way" job.



THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL

for more dependable power production


DUST
DIRT
MOISTURE
ACID
ALKALIES

Name your motor enemy—

this TEFC Tube Type Motor

licks it!

This totally enclosed, fan-cooled motor does its own house cleaning. It is built to operate under practically any kind of dirty or contaminated air conditions. A simple air-to-air heat exchanger system does the trick.

All electrical parts are totally enclosed in a chamber surrounded by tubes. Fan-driven air rushes straight through these tubes carrying away internal heat—keeping tubes free of foreign matter. Cleaning is rarely needed.

Just what does this mean to you? It means you can install this motor any place. Inside or out—in coal dust, soot, rain, fog or mild acids or alkalies . . . name your motor poison—this motor is built to take it. You get maximum service with minimum maintenance.

Remember, too, this motor includes features that have made Westinghouse Induction Motors leaders in industry. For example: Sectional covers and air shields, easily removed by hand. Split bearing housings, with bearings readily accessible for inspection or replacement. Sturdy welded steel frame; stronger, lighter, smaller.

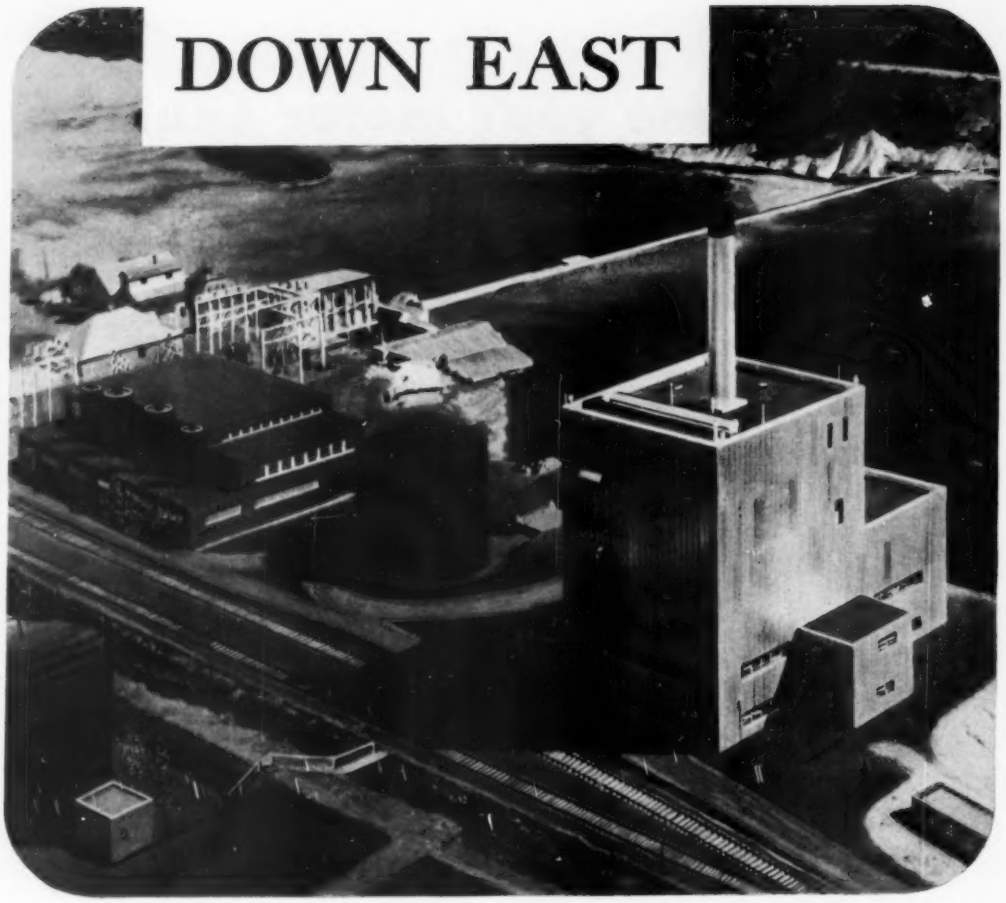
Get all the facts on this TEFC Tube-type Motor. Westinghouse Tube-type Motors for special applications, installed as long ago as 1937, have supplied a wealth of information to aid you in planning your installation. See your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-10376

YOU CAN BE SURE...IF IT'S

Westinghouse

LARGE INDUCTION MOTORS

DOWN EAST



Caribou Steam Power Station of the Maine Public Service Company in Caribou, Maine. Normal capacity: 7500 kw. Top continuous load limit: 9000 kw.

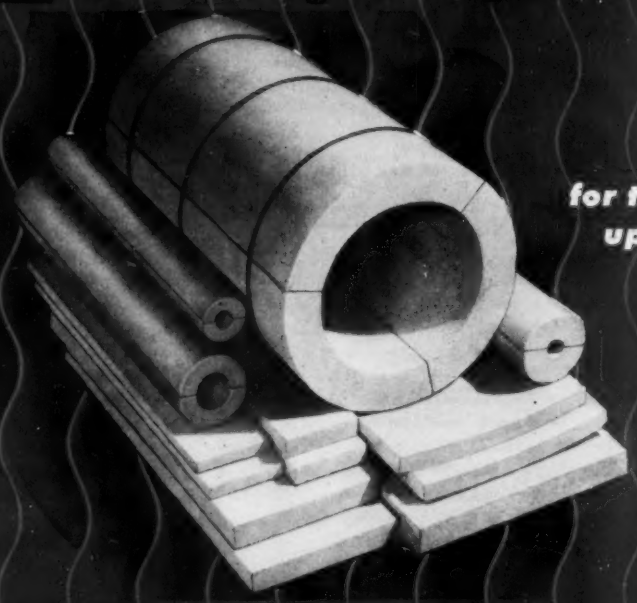
This plant is a typical example of Stone & Webster Engineering Corporation's current work in the design and construction of smaller plants for power purposes.

Our services are available for power projects both large and small.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

Extra Advantages at No Extra Cost



for temperatures up to 1200° F.

—When You Use Kaylo Insulation!

For example, Kaylo Heat Insulation reduces inventory requirements because:

1. Wide effective temperature range —up to 1200° F.—eliminates the need for combination coverings in nearly all operating conditions.

2. Simplified Dimensional Standards allow nesting.

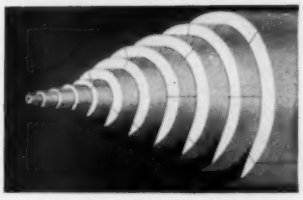
3. Unmatched selection of shapes and sizes reduces the number of pieces required per job.

Kaylo Heat Insulation reduces installation costs because:

4. The material is lightweight, strong and easily handled.

5. It is easy to cut and fit with standard tools.

Kaylo Heat Insulation is a hydrous calcium silicate—the heat-saving material that is revolutionizing insulation practice with its outstanding combination of advantages. Get all of the facts now.



Simplified Dimensional Standards mean that O. D.'s of insulation correspond to O. D.'s of standard pipes, assuring proper fit for nesting, when necessary. With this system of snug nesting, Kaylo Heat Insulation assures fits for all operating conditions, requires less items—reduces inventory stocks.

WRITE FOR FREE BOOK—"Kaylo Heat Insulation." Address: Dept. N-286, Owens-Illinois Glass Company, Kaylo Division, Toledo 1, Ohio.

KAYLO® . . . first in calcium silicate

. . . pioneered by OWENS-ILLINOIS Glass Company

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BRIDGEPORT BRASS COMPANY
CONDENSER AND HEAT EXCHANGER TUBE EDITION
COPPER ALLOY BULLETIN
"Bridgeport" MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND.—IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL

Safety and Efficiency Through Corrosion Inspection, Maintenance

Corrosion must be dealt with realistically because of its effect on safety, production and efficiency. This explains the vital importance of corrosion engineering in the petroleum refining industry.

A serious corrosion offender is water circulated by the millions of gallons for cooling purposes. Contamination may increase or decrease the corrosiveness of the water depending on temperature and other conditions. In most cases, the proper copper-base alloys can be successfully used to advantage. With suitable metals and good operating practice, corrosion can be kept within bounds.

Steel Clad With Brass

Raw liquid gasoline and vapors in crude fractionation and in thermal and catalytic cracking are sometimes very corrosive to steel, especially where the temperature is such that the water content is in the liquid phase.

Experimentation by Sun Oil Company showed that various high-zinc brasses—yellow brass, Muntz metal, naval and Admiralty—are much more resistant than steel to corrosion by sulfur compounds such as hydrogen sulfide, mercaptans, etc. Realizing that brass alone would not provide the maximum safety in case of fire, they lined with brass the pipes, fittings and the steel vessel nozzles in the wet gas, gasoline and water separators of such units. Joints were made by brazing or welding and machined smooth to minimize impingement type corrosion due to turbulence.

Steel was not allowed to come into contact with the raw gasoline containing small amounts of water in order to avoid galvanic attack. It was also necessary to have steel backing up the brass in cases where ammonia was present due to the possibility of season cracking. Some of these brass-lined installations have already been in service for ten years.

In addition, the use of bimetal tubes and non-ferrous linings simplify shut down inspection because it is known from experience that the corrosion rates are low and therefore it is not necessary to open such equipment every shut down.

Galvanic Corrosion Dangerous

No piece of equipment or part is too small to be overlooked from a safety standpoint. Even the failure of a small plug in a pump case opening can cause a serious fire. For example, steel or iron plugs in a brass or bronze or monel metal pump carrying a corrosive liquid may cause the ferrous plug to fail rapidly from galvanic corrosion. On the other hand, a brass plug in a ferrous pump is much less apt to give trouble. This illustrates the fact that the proper material must be used in the proper place.

In Sun Oil Company's square condensers, the steel baffle plates, which are attached to the doors, were originally designed to be separated from the brass tube sheets by means of fiber gaskets. In a short time the ends of the baffles were seriously corroded permitting the water to by-pass some of the tubes. By cutting back the front end of the baffles and welding a section of brass for direct contact with the tube sheet, galvanic attack was stopped.

Temperature Control Important

Sun Oil Company, in addition to river water, generally uses circulating water which is cooled and reclaimed. However, during hot weather, increased water temperatures cause appreciable rise in tube-wall temperatures and has a pronounced effect on corrosion rates.

Condensers and heat exchangers, containing Admiralty and Cupro Nickel tubes are given a thorough cleaning at the beginning of the warm season for more efficient operation. The product side which builds up an insulating coating on the outside of the tubes is thoroughly cleaned with a 10 per cent solution of trisodium-phosphate heated to boiling by live steam. During this cleaning operation the inside of the tube, or water side, dries out and the deposit of silt and slime becomes a dry powder which flakes off easily and can be blown out by compressed air.

Preventive Maintenance

Sun Oil Company believes in preventive maintenance. Corrosion engineers are trained to take charge of certain units for the purpose of keeping an accurate record on the life of the tubing, pipelines and equipment, and to observe any deviation from established safe working conditions. They look for such troublemakers as thinning by corrosion, erosion or oxidation, fouling, breakages, bulging and pitting.

All equipment is inspected and gauged after a definite period of operation to make sure that the metal thickness conforms to their established factors of safety. Continuous records on the temperature changes on the product side and the cooling water indicate when the efficiency drop makes it necessary to shut down for cleaning the tubes. This practice of keeping temperatures as low as possible has a beneficial effect in keeping corrosion attack at a minimum.

Bridgeport's corrosion laboratory service is available to help operators of condensers and heat exchangers select the copper-base alloys which will serve best. (8592)

You get more than just a valve—when you specify POWELL
Here is what you get: First, a valve of finest quality materials and workmanship. Second, a valve that is exactly suited to the actual service conditions. And, third, the help of Powell Engineers in determining the right valve to solve any flow control problem you may encounter.
There are more specifically adapted Powell Valves in use today than any other make.
The Wm. Powell Co.
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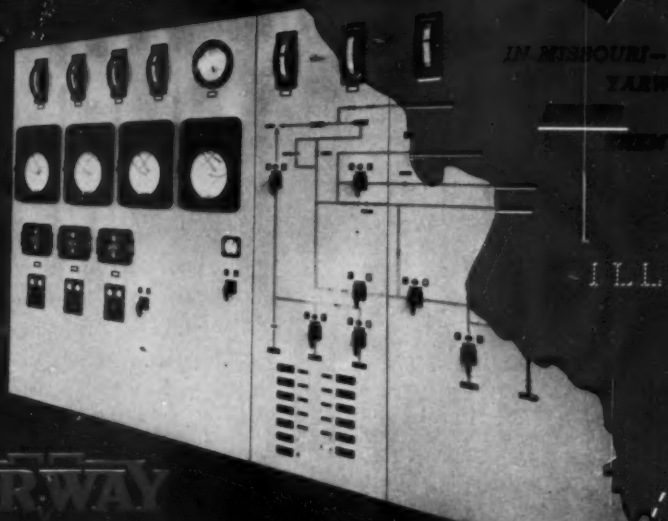
Fig. 11303 W. E. 1500-pound Cast Steel Pressure Seal Gate Valve with welding ends. One of many Powell designs for Power Plants
POWELL
BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES
DEPENDABLE VALVES
SINCE 1846

The Empire District Electric Company orders and reorders...



IN MISSOURI— YARWAY

ANSAS

ILLIN

YARWAY

remote liquid level indicators

In Missouri
(as the saying goes)
you've got to show them your product is good.

Apparently The Empire District Electric Company at Joplin was shown. Not only are they satisfied with 8 Yarway Remote Liquid Level Indicators at the Riverton plant, they also plan to use 8 others in a new installation.

Yarway Remote Liquid Level Indicators bring readings down to convenient eye level. Accuracy is assured because the indicator is operated by the liquid itself . . . by the pressure differential between a constant head and the varying head in the drum or tank. Indicating mechanism is never under pressure. There are no stuffing boxes.

New control unit permits operation of additional Hi-Lo Alarms (light or horn) at any remote locations.

See Yarway Indicator Bulletin No. WG-1823 or Bulletin No. WG-1830 for the Yarway Indicator-Recorder.

MIS

YARWAY SERVICE GOES ALL THE WAY...

EXAS

YARNALL-WARING COMPANY
114 Mermaid Ave., Philadelphia 18, Pa.
Branch Offices in Principal Cities

Power Plant Calls

With the Editors

WISCONSIN Power & Light Co. is *open house* minded . . . They have held open house at several of their generating stations lately and it was our good fortune to attend the one at the Edgewater Station at Sheboygan. . . . For three days, thousands of residents in the surrounding area saw how electricity was generated and learned something about the size and cost of equipment in a generating plant . . . A fine idea! . . . People should know more about where their electricity comes from . . .

Previously, we had traveled up the Wisconsin River — America's hardest-working river . . . Twenty-four power plants in 315 miles develop 188,000 hp . . . No floods on this river . . . Developed with private capital, but consistent with broad public interest . . . Justin Tarvid, the operator on duty at the sparkling new Castle Rock hydro plant, explained the details of this station, built in 1950 — five 3000-kw Allis-Chalmers units . . .

Twenty miles farther on is the new Petenwell Plant, similar in design to Castle Rock but with a slightly higher head: 46 ft compared with about 26 ft at Castle Rock. Petenwell has four 5000-kw General Electric-S. Morgan Smith units . . . The inscription on the plaque is interesting . . . We took a picture of it.

At Beloit Boxboard Co, Edward Kasten keeps his power plant in apple pie order. As Chief Engineer, he not only has charge of the power plant but also the maintenance of the paper machines in the mill . . . His run-around Redler conveyor, which he put in recently, takes coal from an overhead bunker and feeds it to the Combustion Engineering spreader stokers with a minimum of trouble and little dust — a really fine arrangement for a small boiler room . . .

In the basement of the paper mill he showed us the ducks . . . Ducks? . . . Yes, ducks, all kinds of ducks; little ducks, big ducks, Mallards, canvas-backs, etc. all in an open pen near a door . . . "Whose are they?" we asked . . . "They belong to the Company," explained Kasten, "we have had them for years."

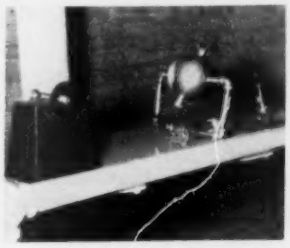
Good time at WestClox Division of General Time Corporation at LaSalle, Ill., where Dudley Diggs, the Plant Engineer, explained the difficult job of converting the electrical system of the plant from d-c to a-c . . . Still some d-c left, supplied by an old 2-cylinder Nordberg uniflow-engine-driven d-c generator . . . Two 1500-kw, 3600 rpm turbine generators supply the a-c . . . Steam-generating equipment consists of three 450-psi, 35,000-lb-per-hr boilers with spreader stokers . . . Interesting note: in several instances the accumulated fly ash *clinkered*. George Shaver is Assistant Plant Engineer at this plant.

New central station construction everywhere . . . At Rockford, Ill. the new Sabrooke Station of Central Illinois Electric & Gas Company is undergoing further expansion. At present, two units are installed, one a 25,000-kw machine and the other a 30,000-kw unit. Two more are to be added and the foundation for one of these is under way. Stone & Webster are the engineers . . . Found our old friend R. S. Kibler, the former Chief Engineer of the Company, no longer there — has located in Connecticut. . . . C. E. Molesberry, Vice President, temporarily taking his place. J. G. Duguid, Mechanical Engineer, kindly took us to the plant and left us in the hands of C. H. Brooks, Shift Supervisor in charge of the station . . .

Beloit's Blackhawk Station is another important link in Wisconsin Power & Light Company's ever-growing system . . . In 1947 the first 25,000-kw unit at Blackhawk went into service. Almost at the same time, plans were made for another unit and this went into operation in 1949 . . . Further station growth is limited by available ground area, hence a new station is being built at Janesville . . . A. F. Bolgrien is District Manager at Beloit. LeRoy M. Abrahamson is District Plant Manager at Blackhawk Station.

George Clark, capable and gracious Chief Engineer of the Paine Lumber Company at Oshkosh, has a fine example of an old plant burning practically 100 per cent wood waste . . . The most fascinating thing about our visit to his plant, however, was the demonstration he gave us of a model of Hero's turbine in operation (see picture and details in column at right) . . . This company makes doors, veneer doors — almost 3000 a day . . .

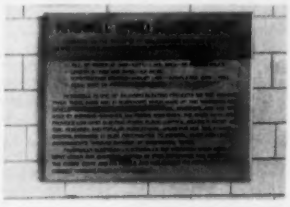
Ever see a real Hero turbine? If not, and the chances are you haven't, here is a picture of one. This little unit was constructed by Chief Engineer George Clark, in the powerhouse of the Paine Lumber Co. of Oshkosh, Wisconsin. While convalescing from an illness last winter, Mr. Clark fashioned this little model of Hero's turbine (around 120 BC) out of a copper float and a few pipe fittings. Later, he soldered a grooved piston ring on one side of the ball to serve as a pulley to run the small circular saw shown in the picture.



When connected to a low-pressure steam supply, and with the throttle just cracked, it runs like nobody's business. We have seen sketches of Hero's turbine for many years but never came across a model of one before.

★ ★ ★

This plaque was placed on the wall of the Petenwell Hydroelectric Power Plant at the time of its dedication on the 28th of May 1951. In addition to data concerning its cost and construction, it contains the following comment on the philosophy involved in its construction:



PETENWELL HYDRO ELECTRIC PLANT

Petenwell is one of 26 hydro electric projects on the Wisconsin River. These dams and 21 reservoirs, which make up the Wisconsin River development, have been financed by individual investors, and are operated by business-managed, tax-paying companies. The river development provides low-cost electric power, flood control, weather, water and soil research, and popular recreational areas for hunting, fishing, boating, swimming. It also contributes to federal, state and local governments through payment of substantial taxes.

Financially, electrically, scenically, the Wisconsin River development under our American system of free enterprise has benefited the entire state and its people and has earned its reputation as "the hardest working river in the nation."

DETROIT LAKES

Cuts Costs More Than 15%

New turbine generator and a general improvement program cut fuel costs more than 15% with increased output of steam, and power, in this municipal power plant. Here's how it was done and the figures to prove it

Fig. 1. Detroit Lakes municipal power plant houses three steam turbine generators totaling 7000 kw capacity

Fig. 2. Newest power unit in the plant is this 4000-kw, 400-psi, 750-F, turbine generator

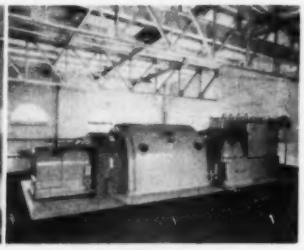


Fig. 3. This 2000-kw turbine unit has been a major power producer since installation in 1938

GENERAL improvement program, featuring the installation of a 4000-kw steam turbine generator, has cut fuel costs at the Detroit Lakes, Minnesota, municipal power plant more than 15 per cent in spite of a rise in production volume. This has been a many-faceted program designed to achieve maximum efficiency and economy in serving power and heating needs of this city of 5,700 population. Actually the plant serves a region with 10,000 residents, including a popular summer resort area.

Growth of Output

Originally built by a private utility, the plant was taken over by the city at the turn of the century and has been operated as a municipal enterprise ever since. This is the way plant output has grown:

Year	Gross Kwh Generated	Lb Steam Output
1920	538,000	18,895,000
1930	1,602,000	36,019,000
1940	4,366,000	47,280,000
1950	9,795,000	83,472,000
1951	9,906,300	75,474,000

The decline in steam output in 1951 was caused not by lessening of demand but by more efficient utilization of the steam.

The modern history of the plant began in 1934 when the first of the present turbines, a 1000-kw extraction type turbine for 180 psi operating pressure was installed. This unit is still used occasionally but serves mainly as a standby. In 1938, the city installed a 2000-kw extraction type turbine operated at 350 psi, 635 F with a speed of 3600 rpm. After 14 years, this continues to be one of the major power producers of the plant. The following year, a boiler with capacity of 50,000 lb per hr of steam was put into service, completing the equipment that carried the city through the war years.

Expansion Program

With electric and heating loads increasing steadily, the city drew plans in postwar years for a major expansion program that would provide needed capacity and at the same time combat the inflationary trend in operating costs. In the winter of 1948–49, a boiler of 75,000 lb per hr capacity was installed. Then, in November, 1949, the city put into service a 4000-kw, 400 psi, 750 F turbine driving directly a 5000-kva 2400/4160-v, 3600-rpm synchronous generator with 40-kw 125-v shunt-wound direct-connected exciter. This turbine, too, is of the extraction type, providing 3-psi steam in summer and 6-psi steam in winter to the heating system, which serves the entire business district of the city. Operating pressure and temperature for the 2000-kw turbine were raised to 400 psi, 750 F so they are identical to those of the new unit.

Good modern auxiliary equipment and improved operating methods combined to promote economy. Coal is purchased on a guaranteed Btu basis at a delivered price of 38 cents per million Btu. Tests on 38 cars have shown an average of 13,675 Btu per lb as against a guarantee of 13,583. The coal is unloaded into a track hopper and then moved by screw and elevator conveyors to a 600-ton bunker then by conveyor over scales to the stokers. The smaller of the two boilers has an underfeed stoker, the larger a spreader type stoker. Both boilers are under full automatic control. The new boiler has forced and induced draft fans and is equipped with an air preheater. Ash is removed by a vacuum ash conveyor.

Plant Auxiliaries

Steam goes to the turbine at 400 psi, is extracted at 3 to 6 psi, and exhausts at 2 in. Hg abs. The big turbine exhausts to a 6,000-sq ft surface condenser, which in turn is served by a steam-jet air ejector working at 250 psi pressure. Cooling water is circulated through the condenser by 4000-gpm centrifugal pumps, one driven by a 100-hp, 400 psi 750 F steam turbine, the others by 100-hp electric motors. A new induced-draft cooling tower was installed in 1950. Condensate is pumped through a heater to the storage tank by a pair of 125 gpm pumps driven by 7½-hp electric motors. Only about 25 per cent of the condensate from the steam heating system returns to the condensate heater and tank. City water, treated in a hot

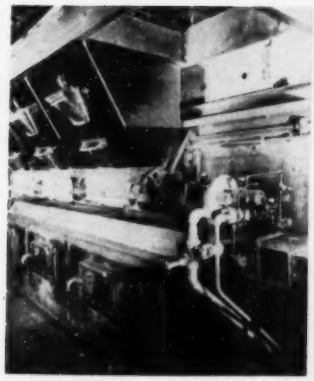


Fig. 4. Fuel is fed to this boiler by a spreader type stoker. The ash is removed by a vacuum system

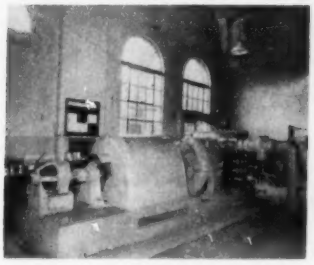


Fig. 5. Oldest unit in the plant is this 1000-kw turbine generator that was put into service in 1934

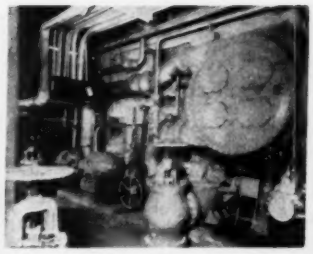


Fig. 6. Surface condenser of 6000 sq ft for new unit, also two 4000-gpm cooling water pumps

Fig. 7. The new boiler is controlled automatically from this new completely-equipped control board

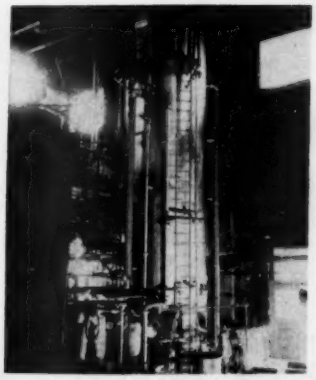


Fig. 8. About 75 per cent make-up is required. It is properly treated in this hot-process softener

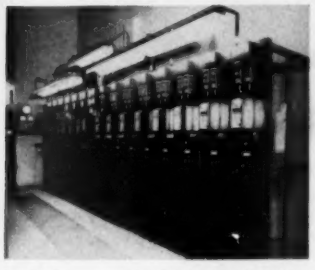


Fig. 9. View of the electric switchboard, with the latest instruments and switchgear for the plant

process softener, is used for makeup. Of the three feedwater pumps, two are steam-driven, one motor-driven.

Installation of a heat reclaimer on the continuous blow-down has been one economy factor, effecting an estimated saving of 154 tons of coal in its first six months of operation. Improved insulation of piping and equipment in the plant has meant additional savings. Maintenance procedures have been instituted to insure that boilers and condensers stay clean and efficient.

Costs — Before and After

Here are the comparative figures on production and fuel costs for 1949, before the new equipment and procedures made themselves felt, and for the first full years of operation under the new regime.

	1949	1950	1951
Net Kwh Generated	8,531,000	8,558,000	8,694,000
Kwh Sold	7,214,000	7,614,000	7,722,000
Pounds Steam Supplied	79,867,000	83,472,000	75,474,000
Pounds Steam Sold	53,465,000	56,717,000	57,918,000
Total Cost of Coal	$159,362.03	$134,252.62	$121,556.34

The big turbine is efficient at partial loads but some additional economies can be expected as the electric demand increases. Peak load in 1951 was 2300 kw and operating load factor fluctuated from 50.1 per cent to 67.8 per cent for the plant.

At the same time that improvements were being effected within the plant, efforts were being made to reduce transmission losses in both the power and heat systems. More transformers and bigger secondary wires were installed, raising voltage to the consumer. Three sets of capacitors totaling 165 kvar (reactive) were put up. Line and meter loss dropped from 15.43 per cent in 1949 to 11.02 per cent in 1950. Elimination of steam leaks and replacement of worn condensate meters increased metered condensate 6.1 per cent from 1949 to 1950 while steam delivered to the heating system rose 4.5 per cent. In 1951, customer sales of steam heat went up 1,200,000 lb while steam output dropped 7,998,000 lb. The 1950 losses were 32.05 per cent and in 1951 losses were reduced to 23.26 per cent. Here too, additional savings are anticipated.

The improvement program in and out of the plant is being directed by C. H. Nelson, superintendent of the Water, Light and Heat Department. Plant operation is handled by Chief Engineer Albert Langer. General supervision is exercised by the Water and Light Commission composed of W. L. Taylor, chairman, Irvin Lidstrom and Albert Beck, with ultimate responsibility in the hands of Mayor F. J. Rogstad and also of the Board of Aldermen.

Principal Equipment, New 4000-kw Turbine Generator City of Detroit Lakes, Minn.

Turbine	4000-kw, 400-psi, 750-F, 3600 rpm extraction-type turbine—Worthington Corp.
Generator	5000-kva, 4000-kw, 2400/4160 v, 3600-rpm, 3-phase, 60-cycle, synchronous generator—Worthington Corp.
Condenser	6000-sq ft—Worthington Corp.
Steam-jet air ejector	Worthington Corp.
Cooling-water pumps	4000 gpm at 75 ft TDH, Worthington Corp.
Condensate pumps	Worthington Corp.
Feedwater pumps	Worthington Corp., Buffalo Pumps, Inc.
Condensate heater	Graver Tank & Mfg. Co.
Hot-process softener	Graver Tank & Mfg. Co.
Induced-draft cooling tower	J. F. Pritchard & Co.
Blow-down heat reclaimer	Madden Co.
Air compressor	Worthington Corp.
Boiler	Erie City Iron Works
Stoker	Detroit Rotograte—Detroit Stoker Co.
Induced- and forced-draft fans	Buffalo Forge Co.
Boiler controls	Bailey Meter Co.
Vacuum ash conveyor	Beaumont Birch Co.
Lubricants	Standard Oil Co., Ind.
Valves	Lunkenheimer
Elec. Instruments	General Electric
Switchgear	Westinghouse

Figuring DEAERATOR FLOWS

The *Heater State Triangle*, first explained in December, gives you simple graphical method for figuring performance for flows of make-up, l-t condensate, h-t condensate and heating steam

BY FREDERIC R. ALEX
Mechanical Engineer
Republic Flow Meters Co.

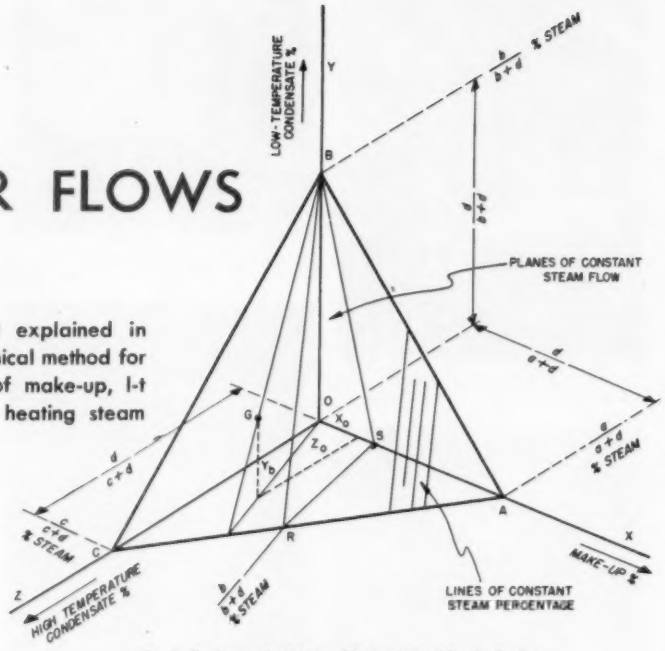


Fig. 1. Fundamental principle of *Heater State Triangle*, for four mass flows: make-up water, l-t and h-t condensate, heating steam

IN A PREVIOUS article, this writer described a graphical method for easily establishing the heat balance of a deaerator heater of the direct-contact type with three mass flows participating in the heat exchange process. That article was entitled Graph Your Deaerator Heat Balance, POWER ENGINEERING, December, 1951.

The method described there was based on the construction of a *Heater State Triangle*, derived from the heat balance equation for the three mass flows. Correlated values of the three mass flows could be easily obtained for any heater operating point by direct reading of the mass flow scales.

The present article develops this method further, and applies it to feedwater heaters with four mass flows; for instance: make-up, low-temperature condensate, high-temperature condensate, and the heating steam.

For the deaerator with three mass flows, the heat balance was expressed in equations 1 and 2, page 73, December 1951 issue. For four mass flows, equating the aggregate heat absorption capacity of the three liquid components to the heat release from the steam, the heat balance for one pound of feedwater consisting of the four components becomes:

$$(ax + by + cz = d(1 - x - y - z) \quad (3)$$

Symbols used in this equation and those to follow have these meanings:

- a, b, c ..... heat absorbed by 1 lb of make-up, low-, and high-temperature condensate, respectively, Btu per lb
- k ..... rated heater capacity, lb per hr
- l ..... maximum make-up water flow, in lb per hr, based on the assumption that rated capacity has to be developed by steam and make-up only
- m ..... maximum low-temperature condensate flow, in lb per hr, based on the assumption that rated capacity has to be developed with steam and low-temperature condensate only
- n ..... maximum high-temperature condensate flow, in lb per hr, based on the assumption that rated capacity has to be developed with steam and high-temperature condensate only
- x, y, z ..... percentage of make-up, low-temperature, and high-temperature condensate in 1 lb of feedwater, respectively
- s_1, s_2, s_3 ..... steam flows corresponding to l, m, and n, lb per hr
- d ..... heat released by one pound of steam, Btu per lb.

After rearrangement, equation (3) becomes:

$$\frac{x}{\frac{d}{a+d}} + \frac{y}{\frac{d}{b+d}} + \frac{z}{\frac{d}{c+d}} = 1 \quad (4)$$

Equation (4) can be represented by a plane in the three-dimensional coordinate system. Figure 1 shows an isometric view of this plane, intersecting the three axes at the points A, B, and C, which are at the distances of $\frac{d}{a+d}$, $\frac{d}{b+d}$ and $\frac{d}{c+d}$ from the origin O. Each intersection point of the plane with one of the axes represents the operating point for which rated capacity must be developed with steam and the respective liquid component only, without participation of all other liquid components.

The percentage of steam in feedwater for these intersection points may be obtained by deducting the values $\frac{d}{a+d}$, $\frac{d}{b+d}$ and $\frac{d}{c+d}$ from unity. These values are $\frac{a}{a+d}$, $\frac{b}{b+d}$ and $\frac{c}{c+d}$, the percentages of steam in feedwater at operating points A, B, and C.

Any point G located in the plane ABC represents a definite state of heater operation. The coordinates x_o, y_o and z_o are correlated values of the three liquid flows, and the difference between the sum of these coordinates and unity is the percentage of steam in the feedwater.

The relations derived in the foregoing must necessarily hold for points located in planes parallel to ABC.

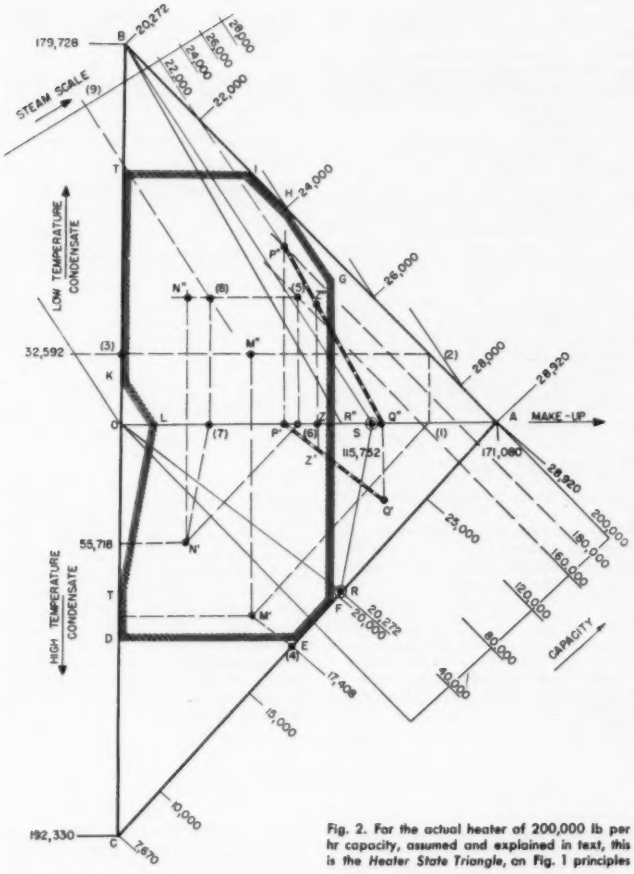


Fig. 2. For the actual heater of 200,000 lb per hr capacity, assumed and explained in text, this is the *Heater State Triangle*, on Fig. 1 principles

Therefore, any actual operating point of a heater within its rated capacity must be located within the space OABC, enclosed by the plane ABC, and three *Heater State Triangles* located in the xy, yz, and xz planes.

How to Construct Triangle

In order to construct a diagram suitable for the analysis of any heater, the following reference lines and reference planes must be known:

1 — Planes representing the various percentages of rated capacity, obtained by calibrating the perpendicular distance between O and the plane ABC, and drawing planes through the calibration points parallel to ABC.

2 — In calibrating the x-axis for percentage of make-up, and the z-axis for percentage of high-temperature condensate, it follows that

$$\frac{a}{a+d} > \frac{b}{b+d} > \frac{c}{c+d}$$

since make-up absorbs most heat, while high-temperature condensate absorbs least heat. Therefore, a point R may be located on the line CA, having the value $\frac{b}{b+d}$, and the lines for the various percentages of steam are drawn parallel to RB, in the plane ABC, through the corresponding points on AC.

3 — The planes representing equal steam flow at rated and fractional capacity may be obtained as follows. As described in the previous article, a constant steam flow line can be drawn through B to intersect the x-axis at point S in the distance $\frac{bd}{a(b+d)}$ from the origin O. The angle between this line and the x-axis will be arctan $\frac{a}{b}$. Thus, the plane for the steam flow at B is determined by the point R, found under (2), and the line BS, and planes representing other steam flows may be obtained by drawing planes parallel to RBS through the calibrating points on AC.

For an actual case of heater analysis the various scales may be calibrated to read in pounds of flow instead of percentages.

Analysis of Actual Case

Now let us take an actual deaerator and construct the *Heater State Triangle* for it, then solve from that a number of typical numerical heater problems. First the procedure for using the described graphical method of analysis will be demonstrated. It will be shown that, with the reference lines and planes found in (1) through (3), any three-dimensional problem may be reduced to a two-dimensional one and solved as explained in the previous article (December 1951 issue).

The following typical data have been chosen:

Deaerator heater operating pressure	5.3 psig
k, rated capacity	200,000 lb per hr
Feedwater temperature	228 F
Make-up water temperature	60 F
Make-up water enthalpy	28.06 Btu per lb
Low-temperature condensate	120 F
Low-temperature condensate enthalpy	87.91 Btu per lb
High-temperature condensate	190 F
High-temperature condensate enthalpy	159.91 Btu per lb
Feedwater enthalpy	196.2 Btu per lb
Enthalpy of steam	1156.3 Btu per lb (*)

The *Heater State Triangle* for these conditions is Fig. 2 and it has been constructed by the following step-by-step method.

Step 1. — Determine the heat absorption by the liquids, and the heat released from the steam:

a = 196.2 − 28.06 = 168.14 Btu per lb
b = 196.2 − 87.91 = 108.29 Btu per lb
c = 196.2 − 159.91 = 38.29 Btu per lb
d = 1156.3 − 196.2 = 960.1 Btu per lb

Step 2. — Compute the maximum flow percentages, and the maximum component flows:

$$\frac{d}{a+d} = \frac{960.1}{168.14 + 960.1} = 0.8554$$

$$\frac{d}{b+d} = \frac{960.1}{108.29 + 960.1} = 0.89864$$

$$\frac{d}{c+d} = \frac{960.1}{38.29 + 960.1} = 0.96165$$

l = 200,000 × 0.8554 = 171,800 lb per hr
m = 200,000 × 0.89864 = 179,728 lb per hr
n = 200,000 × 0.96165 = 192,330 lb per hr

and draw the last calculated values in proper scale as shown in Fig. 2, lines OA, OB, and OC.

Step 3. — Obtain the steam flows in the points A, B, and C, by subtracting the values found in Step 2 from k, the rated capacity.

Steam flow at A =
200,000 − 171,800 = 28,920 lb per hr
Steam flow at B =
200,000 − 179,728 = 20,272 lbs per hr
Steam flow at C =
200,000 − 192,330 = 7,670 lbs per hr

(*) Values taken from: Thermodynamic Properties of Steam. J. H. Keenan & F. G. Keyes, John Wiley & Sons, Publishers.

and graduate the steam scales along the lines AB, and CA.

Step 4. — Locate the point R on AC, with the value equal to point B, i.e. 20,272 lb per hour.

Step 5. — Locate the point S on the x-axis such that

$$AS = k\frac{bd}{a(b+d)} =$$

$$200{,}000\,\frac{108.29 \times 960.1}{168.14\,(108.29 + 960.1)} =$$

$$200{,}000 \times 0.57876 = 115{,}752 \text{ lb per hr}$$

and draw the necessary lines parallel to RB and planes parallel to RBS.

The triangle thus drawn yields solutions of all problems arising in heat balance calculations for the indicated heater, and facilitates sizing of valves, pipes, relief valves, make-up valves, etc.

Typical Problem Solutions

In the following example various heater operating conditions have been assumed, and the solution to each example properly explained.

Example 1 — Having 60,000 lb per hr of make-up, and 90,000 lb per hr of high-temperature condensate available, determine the amounts of low-temperature condensate and steam required to produce rated heater capacity; i.e., 200,000 lb per hr of feedwater?

Solution 1 — Locate point M′, draw lines M′ – (1) – (2) – (3) and read, from scale OB, 32,592 lb per hr of low-temperature condensate. Draw reference line M′ – (4) parallel to OR and read, from scale CA, 17,408 lb of steam per hour.

Example 2 — Having 30,000 lb per hr of make-up, and 60,000 lb per hr of low-temperature condensate, determine the amounts of steam and high-temperature condensate required to produce 160,000 lb per hr of feed-water?

Solution 2 — Locate points N and N′, draw 160,000 lb capacity line in the plane QAB, draw N″ – (5) – (6) – N′ and read, from scale OC, 55,718 lb per hr of high-temperature condensate then draw N′ – (7) – (8) – (9) and read, from steam scale, 14,282 lb per hr of steam.

Example 3 — What are the correlated amounts of make-up, low-, and high-temperature condensate, required to produce 180,000 lb of feedwater with 22,000 lb per hr of steam?

Solution 3 — The required amounts are the co-ordinates of points along the intersection line of the 180,000 lb capacity plane with the 22,000 lb steam plane. Intersect in plane OAB the 22,000 lb steam line with the 180,000 lb capacity line, point P″; draw line P″Q″ parallel to BR″, and line P′Q′ parallel to OR. For any operating point along PQ, such as point Z, the required values may be found by reading

OZ ..... the required make-up flow
ZZ″ ..... the required low-temperature condensate flow
ZZ′ ..... the required high-temperature condensate flow

These three mass-flows are seen to vary between the following boundary values:

Capacity	180,000	180,000
Steam	22,000	22,000
Make-up	74,284	121,543
Low-temp. cond.	83,716	0
High-temp. cond.	0	36,457

Sometimes, for design or actual operating considerations, a heater specification may impose conditions, limiting the flow rates of one or more component flows.

If Components Are Limited—

Conditions of this kind do not affect the procedure of obtaining heat balances in the graphical way, as outlined above. In the case of the assumed heater, for instance, it may be required, that the component flows admitted to the heater will vary within the following boundary values:

Steam from 3000 to 24,000 lb per hr
Make-up from zero to 90,000 lb per hr
High-temp. condensate from zero to 102,000 lb per hr
Low-temp. condensate from zero to 120,000 lb per hr

For this case, the heater diagram should be obtained in the normal way disregarding completely the limiting conditions. However, because of the limited range of the heater, no operation can occur under conditions represented by points outside the area DEFGHIJKLT, which is outlined in the shading on Fig. 2. Consequently, only straight lines, intersection points and planes within the indicated area can be considered as representing the actual operating range of the heater.

X-Rays of Hot Welds

"HOT RADIOGRAPHY" permits taking of X-ray photographs of large pipes, valves and similar units at temperatures as high as 1200 F. This process, called the McElroy-McNutt hot radiography process, has been applied with considerable success to inspection of partially completed welds on hot sections of pipe to check for possible welding defects.

Because hot radiography can be accomplished at high temperatures, the method eliminates several time-consuming steps necessary for usual radiographic inspection techniques. Radiography involves taking a picture of a material by placing a sensitized film on one side of the material and a source of X-rays or gamma rays at the opposite side. With the ordinary technique, before the film can be placed on the weld, the pipe section must be cooled down to about 100 F. With certain types of alloys, this cooling must be preceded by post-heating the weld to relieve internal stresses. Because of the lengthy cooling period involved, the usual practice has been to complete the weld before inspecting it.

However, hot radiography makes it practical to interrupt the welding operation to inspect the weld root where most flaws occur. This technique, therefore, saves the many man-hours of heating and controlled cooling formerly required before the weld could be inspected. Additional time is saved because, if defects are found, it is necessary to chip away only a partially-completed weld, rather than a finished weld.

As an example, welding time on comparable sections of pipe at a large eastern power plant was reduced from 9 days to less than 3 days when the work was inspected by the new process. The technique can also be used for radiography of other forms of hot metallic materials.

Cooling fluid, circulating through hollow chambers of special holder, protects film emulsion from heat

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Steam for Chicago's Great and Growing Medical Center

THE LIST OF EQUIPMENT, page 70, in this article in the March 1952 issue, should have included the following equipment, all manufactured by Sarco Co., Inc., and supplied through the Great Lakes Supply Corp.: 29 inverted bucket traps; 34 No. 13W air eliminators; 4 float-thermostatic traps; 1 No. S65 trap; 7 SB strainers.

How to Get Your Professional Engineer's License

By **JOHN D. CONSTANCE**
Consulting Engineer

If present trends continue, you'll probably need it sooner or later. . . . So eliminate lost motion in going after it, by following the correct procedure outlined here by an expert

PROFESSIONAL STATUS: — The layman is becoming increasingly more aware of the necessity of distinguishing among engineers those who have achieved professional status and legal recognition. Today, in some fields of engineering, a registered professional engineer is required to approve all plans; and, if this trend continues, this situation may become common for all engineering work. Many graduate and presently-employed engineers will begin to lay plans to assume the legal responsibilities of professional status by registering in their respective states.

Requirements: — The steps required to register are not a mystery. Requirements for a license may differ in detail from one state to another, but the procedure for obtaining one by an engineer with average experience is about the same no matter in which state he resides. In general, it is as follows: the applicant writes to the secretary of his state board of engineering examiners for a copy of the state registration act and a copy of an application form for admission to the examination. The law will spell out the specific age and experience requirements. Such information may be obtained from the secretary of the state board involved. For this purpose, names and addresses of the various persons to whom requests are to be made are listed here.

References: — Reading of the law will help the applicant decide whether he can meet age and experience requirements. Usually literature provided by the secretary will discuss the kind of experience acceptable to the board. The applicant's next step is to fill out the form, provide the necessary number of references, and return the form to the board along with the applica-

(Continued on page 112)

Editor's Note: — The author, John D. Constance, has been quite active in recent years in helping his fellow engineers prepare for and obtain professional engineer's licenses, which are more and more being required in all parts of the country.

Here are some of the things Mr. Constance has done:

1 — Authored Refresher Notes for Professional Engineers License Examinations, a very practical 300-page book, reviewed in detail in our April 1952 issue, page 122.

2 — Compiled copies of the latest 18 past examinations for the New York State license, Parts I, II and III, which he sells for a very nominal sum.

3 — Teaches refresher courses for ASME; advises large industrial companies on how to professionalize their engineers; conducts special courses at New York University for preparing exam candidates; tutoring and correspondence work. Readers may address him at 625 Hudson Terrace, Cliffside Park, N. J.

It should also be emphasized that many of the local and sectional bodies of the various professional technical societies, such as ASME, AIEE, ASCE, NSPE, Western Society of Engineers, Detroit Engineering Society and many others, have set up refresher courses and guidance procedures for license exam preparation. Keep in touch with your nearest group for data.

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By GEORGE STEVEN
Executive Engineer
Worthington Corp., Buffalo, N. Y.

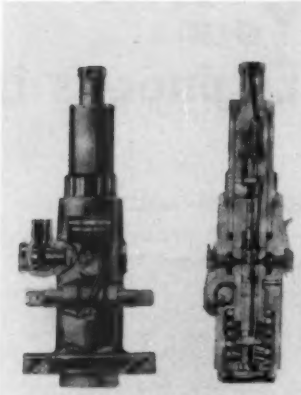

Fig. 1. The dual-plunger fuel pump works as both pilot injection and full diesel

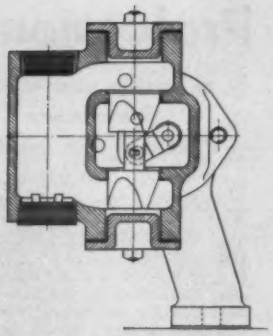

Fig. 2. Gas metering valve gives rapid response to governor

OPERATING PROBLEMS of the Dual-Fuel Engine

DEVELOPMENT of the dual-fuel engine introduced a variety of problems in many ways decidedly different than those encountered in the diesel oil engine or the low-compression spark-ignition gas engine, which had been the only available sources of internal combustion power previously available.

These problems were principally problems of control; and the purpose of this article is to describe, as clearly as possible, how the peculiarities of operation of dual-fuel engines have been overcome in the past 8 to 10 years. Before passing on to a detailed discussion of these problems, it is only fair to state that the dual-fuel engine is undoubtedly less susceptible to combustion difficulties than the average diesel oil engine. It has been the general experience that there is definitely less piston and piston ring trouble and, provided detonation can be controlled, considerably less running gear difficulties.

In this article, we shall see how some of the problems in oil and gas injection were solved. A later article will discuss part load economy, effects of air temperature, gas failure protection.

Pilot Injection

When the dual-fuel engine was first developed, it was common practice to use a separate pilot injection system consisting of a gang-type fuel-injection pump and individual small injection nozzles in each cylinder, all this in addition to the main fuel-injection equipment commonly used on the diesel oil engine. These details are not shown in this article.

Reasonably satisfactory operation is obtainable with this arrangement after the lengths of fuel lines have been properly established and the pilot injection system thoroughly co-ordinated.

The principal remaining problem, however, is the inactive main injection nozzle during gas operation, which creates a tendency toward deterioration and for this nozzle to be in a somewhat unusable state after a long period of operation on gas. There is a definite tendency for the main fuel injection nozzle to collect carbon, which plugs up the injection holes, so that, when switching from gas to oil, faulty operation of the main fuel-injection frequently develops.

Relief can be obtained from this condition by operation on full diesel oil for a period of approximately 15 min each day, which does help to maintain the main injection nozzles in a satisfactory condition.

Necessity for some improvement indicated the possibility of a single-injection pump with one injection nozzle, which could be developed provided a small pilot quantity would properly atomize when discharged through the full size injection nozzle tip.

Many people felt that a small quantity of fuel would not properly atomize when injected through the full size injection nozzle. But attempts were made, nevertheless, and surprisingly enough, it developed that small quantities *would* atomize sufficiently to provide proper ignition.

The result of this finding was the development of the Worthington Dual Plunger Pump, a cross-section of which is shown in Fig. 1.

Dual-Plunger Pump

This design of pump has satisfactorily delivered small pilot quantities in the order of 4 per cent based on a total fuel consumption of 6400 Btu per hp per hr.

In the interest, however, of more reliable operation, it is felt that 6 per cent pilot fuel is better, based on a fuel consumption of 6800 Btu per hp per hr. This amounts to approximately 0.021 lbs of fuel per horsepower per hour, a rather small quantity.

Utilization of this dual-plunger pump provided for a centrally located injection nozzle, similar to that generally used in a diesel oil engine. This nozzle serves for pilot quantity, as well as the 100 per cent fuel oil quantity for diesel operation and provides for a better spray pattern and smoother combustion than the separate small nozzles, which had to be located in a non-central position.

Gas Metering

On dual-fuel engines operating with low pressure gas injection, the problem of metering the gas quantity equally to each cylinder presented some difficulties. Experience has indicated a definite desirability

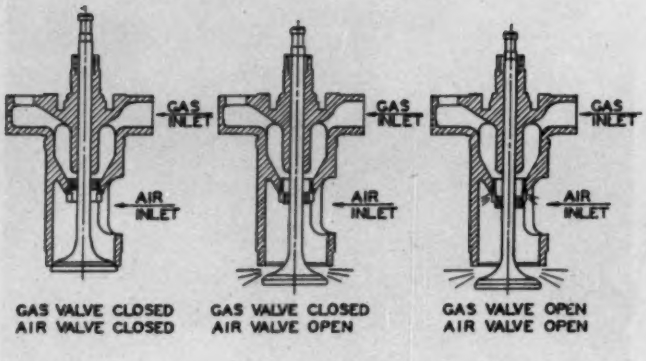

Fig. 3. How one type of gas injection valve works. It produces at the proper time, added movement to admit gas after intake valve has already been opened. It requires a special cam hump

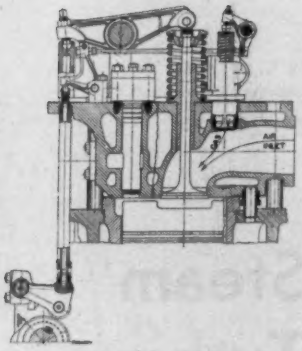

Fig. 4. Second type gas injection valve permits use of standard intake valves and cams

They were principally problems of control. Here you will learn how a dual-plunger pump handles pilot injection and how gas metering and injection valves solved the problems of getting equal quantities of gas to each cylinder on time

of providing a metering valve for each power cylinder and locating the valve as close to the cylinder head as possible. It was found that much better regulation was obtained with this arrangement than could possibly be obtained with one metering valve located at any point in the gas manifold system.

Figure 2 shows the representative type of gas metering valve, one being used for each cylinder and all connected by suitable linkage to the governor lever arm. Each valve is separately adjustable for balancing purposes.

With the gas metering valve located close to the cylinder head, there is a minimum residual volume between that point and the combustion chamber. More rapid response to governor action will take place with such an arrangement than would result if one metering valve were used in the manifold system with the resulting large residual volume between that point and the various combustion chambers.

According to my information, it is generally recognized that the spark-ignition gas engines of the older vintage, with the gas mixing valve located at some distance from the power cylinder and with considerable manifolding between, always had a greater tendency to hunt than a diesel oil engine. In a diesel engine, the governor is working on the fuel racks, providing an immediate response to load change in fuel injection quantity, because there is no residual fuel which can enter the power cylinder unless the pump strokes to deliver the required fuel.

Gas Injection Valves

The gas injection valve can take various forms. One, which was initially adopted and is still used, is to provide a gas cut-off valve on the main inlet valve stem. Figure 3 shows such an arrangement. This required an additional hump on the cam to produce, at the proper time, the additional movement necessary to admit the gas after the intake valve had already been opened. The other type of gas injection valve is a separate cam-operated device, permitting the use of standard intake valves and standard intake cams and also providing the possibility for a somewhat longer duration of gas injection timing. Figure 4 illustrates this type.

As far as we can see, there is no advantage, from a fuel consumption standpoint, between one or the other arrangement, but the separately-operated gas injection valve does permit lower gas pressure supply than does the cut-off valve on the stem, because of the slightly longer time for gas flow and larger flow areas that can generally be provided.

On natural gas, with separate gas injection valves, it is possible to operate with available gas pressures of 12 to 13 psi and on sewage gas with supply pressures of 15 psi. Higher pressure would be necessary with the gas cut-off valve on the stem. In most cases, this is not objectionable, because gas supply pressure is generally higher than necessary and has to be regulated down.

In either type of valve, better diffusion of the gas into the air stream results in improvement of fuel consumption. Timing was developed so that no residual gas would be trapped in the intake ports at inlet valve closing to be swept through during the subsequent scavenging period.

For example, it was found on the first-separately operated gas valve, when an attempt was made to take advantage of the longest timing period, that the valve had been kept open too long and fuel consumption suffered materially.

Fuel Consumption

When the dual fuel engine was first developed in this country, full load consumption of 7500 Btu per hp per hr, utilizing as much as 10 per cent pilot fuel, was considered a satisfactory performance. In recent years, definite strides have been made toward the reduction of fuel consumption and today a fuel consumption of 6800 Btu per hp per hr is commercially obtainable with approximately half of the pilot oil quantity that was originally considered necessary. Better results, of course, have been obtained in research departments, but the above mentioned value is a fairly conservative one and provides for reliable operation without continual tinkering.

We have actually operated successfully with a fuel consumption as low as 6400 Btu per hp per hr and 3½ per cent pilot oil quantity.

By C. W. BELL, Sr.
Engineering Consultant

Fig. 1. Here is an old familiar sight in the power plant — it is turbine overhaul and maintenance time

Steam Turbine PREVENTIVE MAINTENANCE

Now you have your steam turbine dismantled and open for a thorough check-up. . . . What do you look for? . . . How do your findings guide you in carrying out effective preventive maintenance?

IN CARRYING OUT a good preventive maintenance program on steam turbines, to minimize outages and cut costs, you must divide the program into two parts: First part involves testing and checking while the turbine is in operation to help learn what troubles to look for when the unit is opened and in deciding when it needs to be dismantled. Second part involves internal inspection of the turbine when it has been shut down and dismantled.

The first part of the program includes standard testing conditions and comparisons of present and previous performance, checking of vibration, condition of lubricant and other factors. That part of this program was discussed in the July issue. Now we shall look at the second part, inspection of the turbine after it is open.

Emphasis during inspection should be on:

(a) What must be done while this unit is open?
(b) When must the next general inspection and overhaul occur?
(c) What work must be prepared for?
(d) Historically, what deterioration since last overhaul?

Usual scheduling preliminaries, the laying out of a job plan and the checking of materials required are assumed to have been accomplished before any important unit is actually removed from service.

In addition to the usual thickness gages, micrometers, taper gages, scales, flashlights, and the like, the Inspector should be equipped with: an adjustable 20–30–50-power, pocket-type magnifying glass; one flat and one 3X dental mirrors; also one or more adjustable exploring mirrors of larger size, possibly 1 in. by 2 in. and 1½-in. round, both flat. A bullseye pen light with a flexible goose neck extension is often helpful.

Measurements to Take

In the process of dismantling, measurements should be taken carefully to determine deviations from last previous records. These would naturally include: bearing caps and bearing babbitt (running), clearances; thrust bearing position and running clearances; oil deflectors top, side and bottom clearances; clearances of all steam packing and steam deflectors, and other details, beside the well-known wheel and bucket or blade clearances.

During the process of unbolting, particularly on older units, it is common to find that shell joints open up when certain bolts are released. These irregularities need to be recorded carefully since they function negatively in the fitting up of internal parts for final closing and rebolting. On large units it is good practice to bolt up such units with all internals removed to determine better how to refit the internal parts.

Condition of bearing journals may indicate several important trends.

A pitted surface may indicate too much moisture in the oil or it may be the result of electrolysis from stray current through faulty insulation on the normally isolated generator bearing. The writer has seen this happen on governor drive gears and journals also. It requires a magnifying glass to identify the type of pits or craters.

An excessively-polished journal usually appears in conjunction with a bearing whose contact angle is too great; that is, the contact is high enough to start pinching the shaft. A contact strip roughly 25 per cent as wide as the shaft diameter is satisfactory. That is, for an 8-in. shaft a 2-in. wide contact strip parallel with shaft is good practice. When the contact angle approaches the 45 deg lines (90 deg included angle) the hazard becomes critical.

Bearings must be fitted so that they accept plenty of oil and form an adequate load-carrying film where

DON'T CLIP THIS ARTICLE

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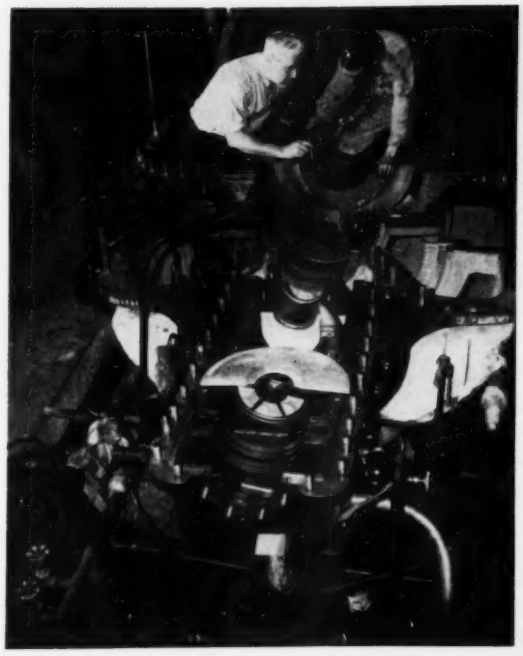


Fig. 2. These engineers are checking internal dimensions, clearances, blade path erosion, etc. Some repairs were made by metallizing

Fig. 3. Hoisting the "internals" out of one of the large turbine units at a plant of the Detroit Edison Co. (Courtesy—The Synchroscope)

needed. They must also be free enough on the sides to permit a slight off-center roll or shift, when starting from a stand-still, to get the journal off the dry contact line onto adjacent oily surface. (See also comments on misalignment.)

Thrust bearings of various designs and ages have tended to fail more often than shaft bearings. Each design, where any failures or near failures are discovered should be studied individually. It is usually possible to locate a cause and make corrections.

Clearances and Alignment

As stated above, a multitude of clearances must be taken in the steam path within a turbine. The manufacturers original clearance charts and blank forms are helpful here. During the taking of these values a careful watch must be kept for marks of rubs. Some units change alignment considerably when hot. This may be a natural change, such as those deflections due to non-symmetrical steam connections or it may be an un-natural change due to some external influence. Rub marks may be even more significant at times than the measured cold clearances.

General alignment is naturally affected by other developments also. One major item to watch is concrete foundations. Heat causes concrete to grow. Oil causes disintegration. General misalignment of foundations is probably rare, but we have found cases of this due to inadequate footings.

Radial misalignment of nozzles with respect to wheel blades or buckets is a very critical item on some units. New designs are likely to have self centering features. It is sometimes possible to modify parts in an old unit to get the benefit of newer practice. This makes for better economy and less maintenance expense.

Any serious side misalignment of a solid shaft unit or one with rigid couplings should show in inconsistent bearing marking. In some cases a shaft whip may develop from this. Extreme cases will show in a coupling-face rust pattern.

For flexible-coupled units, the couplings will deteriorate rapidly. (See also remarks on vibrations.)

On machines with diaphragms extra attention must be given to any tendency for these to "dish" or sag. A hard rub between diaphragm and a rotating wheel may cause a serious wreck.

Steam Path Erosion

Starting at the dew point there will be damage due to entrained droplets of moisture through the remaining portion of the steam path.

Modification of drainage openings and special connections are often required in old units to reduce this damage and to improve economy. Free water in the steam serves as a braking influence.

All details in the internal steam path must be examined critically for loosening up of fastenings such as the attachment of shroud sections to wheel buckets, the soldering of lashing wires to wheel blades, possible signs of irregular sympathetic vibrations.

In machines using large area diaphragms, good judgment must be excercised in evaluating erosion damage, since this occurs mostly next to the outer rim, at the point of support.

Newer machines are quite likely to have steel diaphragms, therefore may be repair welded under expert supervision. Any of those designs depending on either cast-in bridges or cast-in nozzles to support the center must be watched for threats of loosening of the support anchors and for cracking of the outer rim. Load carrying ability may be checked by applying load in the form of calibrated springs and measuring the deflections.

Erosion will be much more severe at times when pH values in the boiler feedwater are low. Spasmodic sag

(Continued on page 108)

These Practical Tips Help You Raise Industrial PF

Use capacitors, synchronous motors and wound-rotor motors properly to decrease penalty charges, increase available energy and feeder capacity, improve lighting and prevent insulation heat break-downs

By PAUL C. ZIEMKE
Oak Ridge, Tenn.

YOU HAVE SEEN in two previous articles how a thorough and detailed survey of your industrial plant's electric power distribution system yields tremendous benefits. In the May issue, you saw how you must check all circuits, right down to the last lamp in the gateman's shelter for load-carrying capacity, voltage, insulation condition, proper motor size and power factor. In the June issue, we showed the instruments required for a proper survey and how to use them.

Now let's assume you have found your system's power factor lower than you think it should be. What can you do? Here are some useful tips.

PF Correction by Capacitors

Welding machines, transformers, induction motors, induction furnaces, fluorescent lamps, and a host of other inductive loads consume only a part of their applied current, thus leaving only a portion of it to active productive or power use. A serious proportion serves no other purpose than to supply the magnetic fields of the equipment. This portion is known by various terms, such as wattless, reactive or magnetizing current. The higher the percentage of this nonproductive current, the costlier your power bill — all quite unnecessarily. By reducing this wattless current through the use of synchronous motors wherever possible, or by the correct installation of capacitors, this needless drain can be drastically reduced.

Study of one group of consuming utilities recently disclosed that they paid $81,000 in power factor penalties last year. A little work with the slide rule will prove that $81,000 will neatly amortize an investment of at least $810,000. This $810,000 would pay for the extra capacity of a 40,000-kva substation, complete with armor-clad switchgear.

Penalty Charges Costly

Poor power factor conditions are reflected in these salient ills: 1, Penalty charges enforced by the power company; 2, reduced energy available; 3, decreased feeder capacity; 4, low foot-candle illumination; 5, deteriorated insulation values due to heating.

Monthly payments in penalty charges are really a compensation to the power company for use of the facilities of power distribution in excess of those required to carry a stated load at a reasonable power factor. Tests have proved that energy losses vary inversely as the square of the power factors under consideration. As the power factor deteriorates on a circuit, demand for current increases in order to deliver the same amount of kw load. A power circuit is designed to operate effectively at an established temperature. To exceed that temperature is to court trouble from early insulation failure, when sustained high temperatures are common offenses. Consequently, it is obvious that if we improve the power factor, the circuit can carry more kw-producing amperes of useful work than formerly. Demand for more capacity from existing installations is met when the power factor is built up to, and is maintained at, near unity or 100 per cent.

Peak Efficiency—High Profits

Three basic factors must be considered in making an analysis of in-

Fig. 1. Six of the 12 G.E. capacitors recently installed and saving $150 a month at Montrose Chemical Corp. of California, plant. Each capacitor rated 15 kvar, 3 phase, 60 cycle, 460 volt, complete with fuses in thermal box. Originally installed to reduce overload on transformers due to plant expansion, they raised plant power factor from 0.76 to 0.976. This is a typical case; you find many similar ones

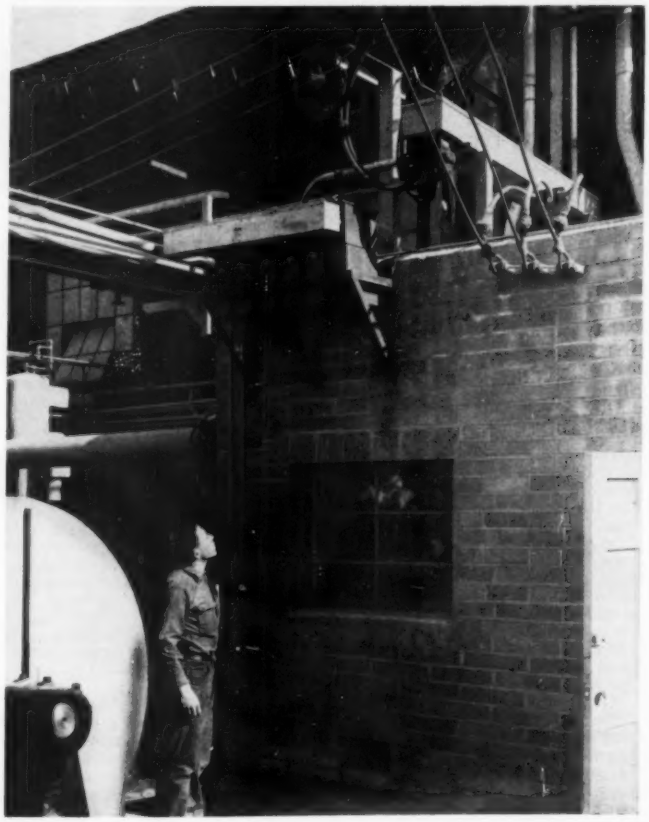


Fig. 2. Sometimes motor rewinding job can not only save copper and power but also raise power factor

creased efficiency and top voltage for the connected loads. Furnaces and other heating devices will actually draw more current than before. But oh! what an improvement in heating values! And the end result — the kilowatt hour consumption remains the same.

By the same token, the kilowatt hour requirements for the plant lighting will increase somewhat. Yet the improvement in lighting intensity will increase almost ten-fold.

Motors, likewise, will consume but little more energy under improved voltage conditions and this is immediately offset by enhanced starting qualities, greater horsepower output, and cooler running.

Best technique to employ in determining the proper number of capacitors for a given installation is to assume that the load will fairly closely follow a definite pattern for the 24-hour day, every day. Then correct for minimum conditions and use a reserve bank of capacitors for the peak loads that can be switched in as the peak load conditions arrive. The manner and quantity in which these capacitors are switched in or out of the circuit will depend largely on the particular type of load cycle in the plant.

How to Figure Capacitor Ratings

To determine equivalent kva of 60-cycle capacitors for use at any frequency less than 60 cycles, multiply the required kva of correction by the ratio of 60 to the frequency. For example: If the circuit requires 100 kva of correction at 25 cycles, the result will be $(100 \times 60) \div 25$, or 240 kva. This indicates the installation will require twenty-four 10-kva units of 60-cycle capacitance, or their equivalent, and the capacitors need bear the 60-cycle rating.

To determine equivalent kva of capacitors for use at any rated voltage, less than rated voltage, multiply the required kva by the ratio R of the square of the rated voltage to the square of the actual voltage. That is $R = Er^2 \div Ea^2$, where Er equals the rated voltage, Ea equals the actual voltage and R equals the ratio. Example: 100 kva of correction at 208 v will require

$$100 \times \frac{230 \times 230}{208 \times 208} = 122$$

which is 122 kva of 230-v capacitors.

Temperature Tolerances

Generally, the average capacitor is rated for operation in an ambient temperature of + 40 C maximum and under normal atmospheric conditions. Under abnormal conditions of dust, fumes, humidity or temperature special types are provided by most manufacturers. The standard capacity tolerance of standard power factor correcting capacitors is + 12½ to 0%. They are also designed to operate on circuits the average voltage of which, over any 24 hour period, exceeds the rated voltage by not more than 5 per cent. By the same token, permissible working voltage of the capacitors will not exceed 110 per cent of the rated voltage.

Most power companies base their power rates on two factors:

1. On kilowatt-hours, or the number of units of energy consumed
2. On maximum kva demand during the fixed period of time, normally. This is (voltage × current) ÷ 1000.

Of necessity, the current included on this basis includes the "wattless" as well as the actual "power" current.

High-Potential Capacitors

Shunt capacitors are especially well adapted to substation service where for a well-balanced three-phase load they may be connected in either delta or star. The choice is determined by the system voltage level, wave form, cost and relative kvar ratings. Experience has proved the delta connection effective for voltages below the 2,400-v. values. With that connection, internally faulted units may be subjected to full phase-to-phase fault current.

In case this fault current is high, gas pressure may be generated in sufficient quantity to rupture a case seam before disconnection may be achieved. Proper ratings of fuses will offer usually successful interrupting capacity to clear most faults before rupture occurs. With one bank faulted, the rapid discharge of the adjacent capacitors may cause heavy, instantaneous currents to pass through terminal connections.

Star Connection

In the range of voltages above 2,400, practice has proven it desirable to use the star connection where the grounding of the neutral of the bank has many distinct advantages. If individual fusing is neglected, extremely hazardous conditions may develop where the neutral is operated ungrounded, since if one unit fails, the balance of the bank fuses may remain intact. The resulting harmful unbalanced voltage may cause other unit failures. With a securely-grounded neutral, costs can be shaved since capacitors of lower insulation value may be used.

Voltage rating of the grounded neutral installation should match that of the circuit voltage. Failure of one unit, protected by individual fusing, will not cause serious voltage unbalance where the unit is installed in a bank with well grounded neutral. The neutral bank of capacitors tied in star should be well coupled mechanically with the neutral of the supply transformer bank, thus providing a fine, low impedance path for the control of harmonic currents.

Case Grounding

Article 460 of the Electrical Code specifies that: "Capacitor cases shall be grounded in accordance with Article 250" and "All live parts of capacitors which are connected to circuits of more than 600 v between conductors and are accessible to unqualified persons shall be enclosed and isolated." Late models of containers have ample lugs provided for the attachment of ground leads and the cases are usually of substantial stock to warrant moving the equipment under rigorous conditions.

Single-phase units are made with either one or two bushings. The unit supplied with two bushings has the advantage of being used for any type of connection and may be grounded as long as interior insulation values remain above par. Single-phase units have the case grounded when tied to a circuit operating with one leg grounded, such as a three phase four wire multigrounded neutral system.

(Continued on page 106)

Engineering Education As a By-Product

By **ANDREW W. KRAMER**, Editor

LAST WEEK one of our editors came back from a field trip and told about a visit to a brand-new, sleek, modern power plant — a municipal light and power plant for a small town of perhaps 10,000 population. This new station with a single, high-pressure boiler, under complete automatic combustion control, supplying steam to a single new turbine generator, was built adjacent to the former old plant. Indeed, the wall of the old plant had been torn out so as to provide easy access from one plant to the other. The old plant is still being kept for standby service.

Curiously enough, however — but perhaps not so curiously — the operators like the old plant better. They can't really explain why — they admit the new plant is a honey when it comes to modern equipment. It has all the latest gadgets and is as spick and span as a Baltimore stoop on Saturday morning; but somehow they yearn, or think they do, for the old, messy plant with its antiquated equipment.

Of course, this is nothing but a manifestation of the age-old tendency for people to resist change, a tendency that grows stronger as one grows older. The old-timers in any industry, in any field, will always speak glowingly of the old days because, in their memories, they forget the hardships and remember only the pleasant aspects of their work. Just mention a Corliss engine to an old-time engineer and watch his eyes light up. Those were the days! Engineers were engineers in those days, not dial watchers and button pushers! They forget the 12-hr shifts, the back-breaking drudgery in the boiler room, the nights and Sundays spent in repairing broken-down machines, the hair-breadth escapes dodging cylinder heads and exploding flywheels. And this is as it should be, because these men, who came up through the school of hard knocks, should be proud of what they learned the hard way. They were men of vast practical experience, hard working, ingenious and often good in theoretical matters, within limits.

"Easy accessibility to plants is non-existent today"

No Armed Guards

Despite the long hours and hard physical labor, life was less rigid in the Corliss-engine days. There were no armed guards at the gate, indeed more often there was no gate. Anybody with sufficient curiosity could usually stick his head in the engine room doorway and watch the rhythmic motion of the engines — always a fascinating sight for these with a trace of engine oil in their blood.

In many ways, this easy accessibility of plants and processes provided an unusual opportunity for the education of the younger generation, an opportunity more or less non-existent today.

In a letter I received only a few weeks ago from a retired engineer, now living in California, he directed attention to that phase of his education. "We kids," he wrote, "got a college education coming home from school (in Saginaw, Mich.). We had a 3½ mile walk[1] and would drop in to see every line of work: saw mills, planing mills, roundhouses, machine shops, boiler works (Wickes made their own hydraulic equipment for flanging heads and caulking tubes). There were large tin shops for cyclones and exhaust systems for wood working. In the '80's there were 83 saw mills on the Saginaw River. Whittier's saw mill had a 1000-hp Corliss engine with a four-foot leather belt, one inch thick."

There can be little question concerning the value of the easy accessibility of these various plants to the kids of those days. It gave them a daily familiarity with machines and processes, with trades and the nature of work that children of today do not have. It stimulated mechanical aptitudes and talents that otherwise might have remained hidden. The engineer of a power plant was a great man to those kids — a kind of hero who, with great and reckless abandon, felt the moving parts of the Corliss engines. It was an inspiration to watch him; he commanded the respect and admiration that led many of us, later on, to the pursuit of engineering. In my own case, I spent countless hours on my way home from school looking in at a foundry, watching the molders at work; or at the door of a machine shop, fascinated by the curls of steel from drill presses or lathes.

Out came the rod so fast he couldn't hang on to it and it sailed over the engine and out of the power house

It Was Play

The best thing about this type of education was that it was spontaneous. It was not forced; there was no teacher to tell us "Watch this or that"; we were under no obligation to write a composition about what we saw. It was play, but we learned.

There was more to see in those days than now in a power plant. Our beautiful, sleek, highly-efficient stations of today are marvels of human ingenuity — among the most completely automatic entities human effort has produced, but there is little to see. Few things move. A 100-megawatt turbine generator unit is an awesome thing when one knows what it is and

(*Continued on page 112*)

[1]Now the school bus picks them up, even if only half a mile from school.

Fig. 1—Left to right, Karl J. Mertz, H. W. Meyer, and AIEE President F. O. McMillan examining exhibit of old electrical instruments at the Summer General Meeting of the AIEE in Minneapolis, Minn.

Electrical Engineers View Historic Exhibit

THE TREMENDOUS breadth and scope of electrical engineering and its impact upon every aspect of our lives was reflected in the almost two hundred technical papers presented at the Summer General Meeting of the American Institute of Electrical Engineers held in Minneapolis June 23 to 27. These papers covered everything from the physiological effects of microwaves to a nationwide numbering plan for our telephone system and the critical shortage of engineers. Curiously enough, the latter problem seems to be one of the most difficult to solve, and the general session devoted to a discussion of this subject was one of the most interesting and best attended. The meeting was attended by over 1700 engineers from all parts of the country. Incidentally, the membership of the AIEE now stands at an all-time high of over 42,000.

The Summer Meeting is always the occasion of the induction into office of the incoming president, this year D. A. Quarles, President of the Sandia Corporation. Also, at this meeting, the Lamme Medal was presented to Arthur E. Silver, retired engineer from Ebasco Services, Inc., of New York. Mr. Silver is well known for his work in the development of transmission equipment and, in particular, in connection with the outdoor high-voltage substation. The Medal was presented to Mr. Silver by President F. O. McMillan.

An interesting feature of the Minneapolis Meeting, aside from the numerous inspection trips, was an exhibit of old electrical equipment all of which had been gathered in the Minneapolis area. Among the devices was an original Edison *chemical* electric meter, and a half kilowatt Edison bi-polar generator, originally installed on a Columbia River boat but later brought to Minnesota. At the exhibit this machine was belted to an a-c motor but despite considerable fussing with it, it could not be made to generate. This intrigued the fancy of the local newspaper editors, and several of the Minneapolis dailies carried headlines to the effect that the nation's electrical experts were stumped by Edison's little generator.

Among the features of general interest was the address by Dr. Lawrence R. Hafstad of the Atomic Energy Commission at the luncheon on Wednesday. Dr. Hafstad who is in charge of reactor development gave some interesting figures concerning the world's energy resources. While we still possess great reserves of coal, Dr. Hafstad pointed out these coal reserves were small in comparison with the energy contained in fissionable materials and in the end, only these fissionable materials might serve to tide us over until the time when we would develop methods for utilizing the energy in solar radiation.

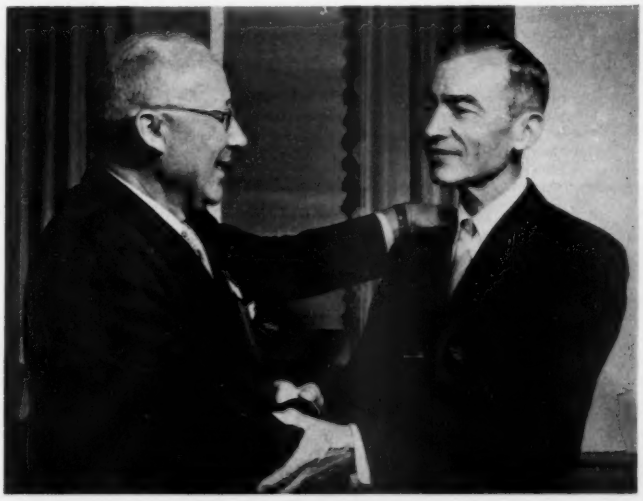
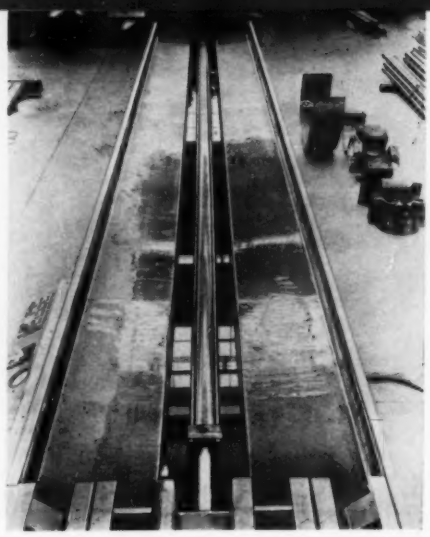


Fig. 2—Retiring President F. O. McMillan congratulating D. A. Quarles of the Sandia Corporation upon his election to the presidency of the Institute

Power Engineering

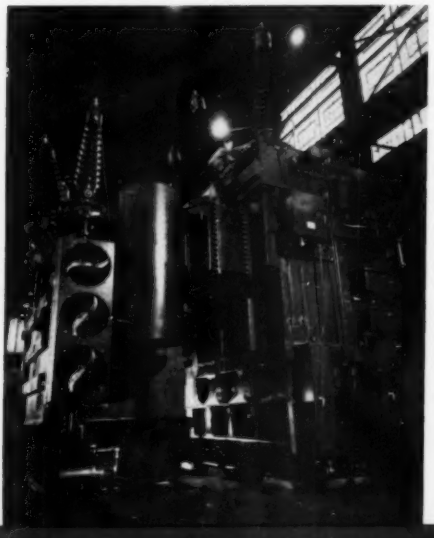
With foundations and substructures completed after twelve months work, erection of structural steel gets started for the second half of Commonwealth Edison's Ridgeland generation station



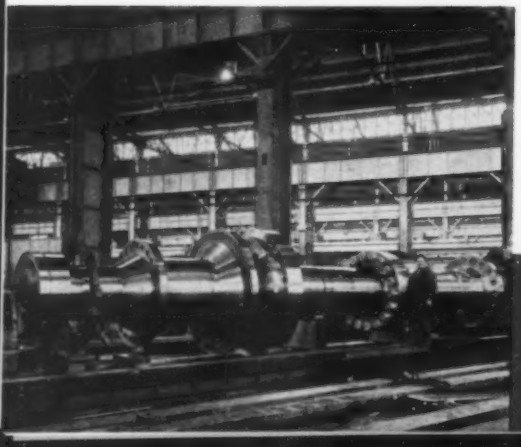
A 22-ft stroke hydraulic cylinder built from standard-type parts and that features a 24-ft long solid steel piston rod that does not sag under its own weight, opens new applications for air and hydraulic cylinders

Mine Safety Appliance Co. oxygen therapy unit in action. It can be used safely to administer oxygen to victims of heart attacks, heat prostration, gas inhalation and other conditions requiring oxygen

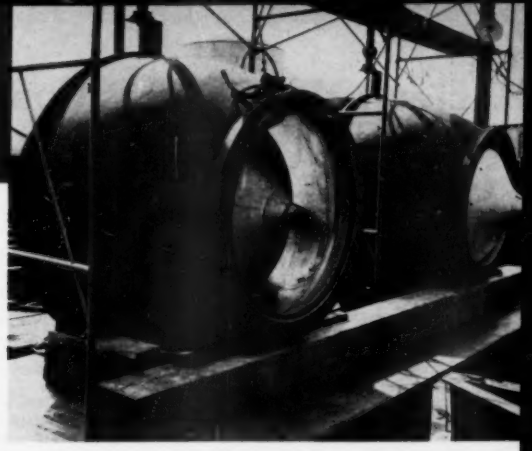
This 230-kv Westinghouse transformer for the Central Illinois Public Service Co. is rated 150,000 kva and weighs 250 tons. It contains 77 miles of copper wire and 22,000 gal of insulating and cooling oil



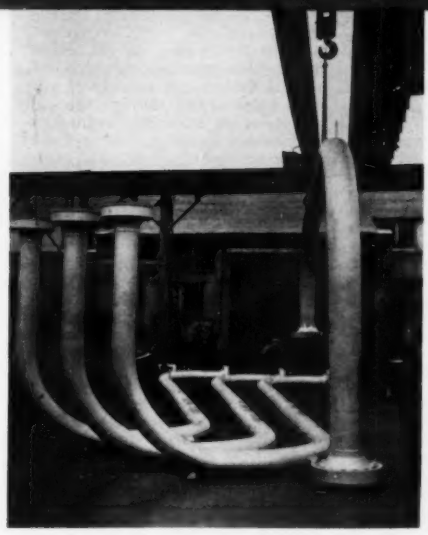
Turbine and generator sections of a shaft for one of the Wolf Creek hydroelectric units coupled together for a precision check and lineup in the erection shop of the Baldwin-Lima-Hamilton Corp.



NEWS REEL



Hollow jet valves with seats formed by Monel overlays for the Boysen Dam, Wy. These valves are part of the hydraulic gear fabricated by the Pacific Coast Engineering Co., Alameda, Calif.



Several sections of chrome-molybdenum main steam leads, one 14 in. and three 10 in. dia., readied for shipment at the Blaw-Knox Co. where they were fabricated for the Bokaro Steam Power Plant in India

Man from Mars? Miss Shirley Stahlbrodt of Eastman Kodak swaps quips by telephone with Earl Wallace, one of their safety engineers as he demonstrates fire fighting equipment at their safety pageant

Solid Monel tugboat shaft, which became worn, being sprayed with stainless steel to build up the worn area. This is a Metallizing Engineering Co., Inc. process. After the area is sprayed it is machined to size

Heart of a General Electric turbine-generator is this rotor, which weighs 42,200 lb. In operation, it will revolve faster than the speed of sound to turn the shaft of a 50,000-kw generator

Electricity Gasifies Coal—Latest Step in Underground Work

Recoverable fuel reserves represent 96 per cent of the world's energy. . . . Since 1868 gasification has been considered as a means of extracting this energy. . . . Use of *electric current* to prepare fuel beds for gasification is latest development. . . . Two tests indicate it may prove to be an economical way of enhancing mineral fuel resources

LABORATORY and full-scale field tests completed after four years by the Missouri School of Mines in cooperation with the Sinclair Coal Co. attacked an old problem, underground gasification of coal, with a new approach — electrocarbonization. Their findings, particularly those dealing with the electrical cross-cutting or linking of coal beds, were recently employed by the U. S. Bureau of Mines and the Alabama Power Co. in the third underground gasification test at Gorgas, Ala.

It is believed, by the electrical carbonization and gasification of coal in place without mining, a large-scale pilot plant can be designed and successfully operated to provide gas for domestic and industrial use. Ultimately, development of this method may improve efficiency of production and utilization of fuel reserves, not now achieved by "ordinary" mining methods. Leading scientists and engineers at the first International Conference on Underground Gasification of Coal at Birmingham and Gorgas, Feb. 12–14, seconded this belief.

Principles of Gasification

A full description of the method of underground gasification as studied by the Missouri School of Mines may be found in their bulletin, No. 78 (Technical Series), issued January 1952. Titled, The Process of Underground Electrocarbonization, it is written by J. D. Forrester and Erich Sarapuu, who conducted the study.

Underground gasification, generally, is the conversion of mineral fuels to gaseous form by treatment of the raw material in place. A necessary feature of any variation of this process is a heat zone induced progressively through raw source material, such as a coal seam.

Underground electrocarbonization, as tested by the Missouri School of Mines, briefly is a procedure whereby the fuel constituents of coal (volatile matter and fixed carbon) are obtained by means of electric current. It is basically of two general stages: 1. Carbonization or coking in place by electrical heat and derivation of volatile-matter gases through boreholes previously driven from the surface; 2. Conversion of fixed carbon to gaseous state by combining it with oxygen, air or steam, and the resulting yield of additional products through the boreholes.

Underground gasification has been carried on for years in many countries, notably Russia. In 1917 Lenin included it in the Russian research program, but active experimentation did not begin there until 1931. Since then Russia has produced more than 5,000,000,000 cu ft of gas with varying success. Sweden has used underground gasification methods to treat oil and shale deposits. A German scientist attempted conversion of oil shale in Estonia during World War II with no practical results. Treatment of oil shale in Germany itself began in 1944 with some success. Belgium, England, Italy and France have all experimented with the process.

Underground gasification of fuel, particularly coal, in the United States dates back to 1946 when the U. S. Bureau of Mines and the Alabama Power Co. cooperated on their initial test at Gorgas. Results of this test proved there was no difficulty in maintaining combustion of coal underground, and that combustion under proper conditions was complete. (POWER ENGINEERING, September 1947 issue.)

Gasification in this and subsequent experiments at Gorgas (until just recently), as elsewhere, have depended upon an adaption of one or more of four basic methods, none of which incorporate thermal recovery techniques.

Four principal methods proposed are: chamber, borehole, stream and percolation. In the first, the coal bed is developed by a system of parallel and cross entries, with broken coal in the latter forming the gasification chamber. In the borehole method, parallel entries are connected with small holes drilled through the coal bed at 5-yard intervals. Gasification is effected in the holes. Both methods require extensive underground labor.

The stream method, in which a rectangular portion of the coal bed is laid out between two parallel entries connected at their extremities by a cross entry, relies upon gasification of the pillar of coal thus formed. Russia reported successful operation with this method in steeply pitched beds. It is similar to the first test method used at Gorgas. Here again, extensive underground work is necessary.

The final method, percolation, derived from an idea first patented in 1909 consists of a number of boreholes drilled, usually in concentric circles, from the surface into a flat-lying coal bed. Combustion is started in the center holes and progresses outward. Control of combustion is difficult, but there is little or no underground excavation.

Shaftless Extraction Is Necessity

An economically successful method must involve no underground preparation. Consequently it became necessary to find an inexpensive yet practical way to connect boreholes sunk from the surface to the coal bed. Shaftless methods for cross-cutting a coal bed may be summarized: 1. Filtrational linking, 2. Hydrolinking, 3. Directional drilling, and 4. Electrolinking.

The first, for horizontal beds, depends upon heat of combustion from boreholes to cause shrinkage and fissures in the coal between the holes and thus provide a burning chamber.

Hydrolinking, accomplished by

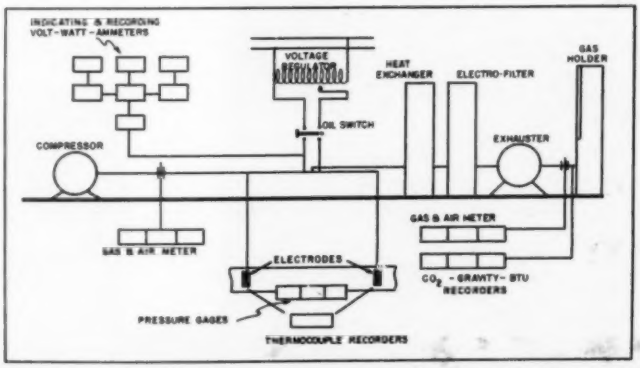


Fig. 1. Diagram of the electrocarbonization pilot plant as used by the Missouri School of Mines in their field tests. An electrofilter and exhauster were not actually installed during tests for economic reasons

If you want a copy of this interesting bulletin, write The Editor, POWER ENGINEERING, 110 South Dearborn St., Chicago 3, Ill. For convenience, use the postage-free card, page 121.

sinking pipes into boreholes and directing their nozzles toward neighboring holes, uses high pressure jets to disintegrate the coal, forming fire channels. Channels 20 m apart were reportedly opened this way in Russia in less than 8 hrs.

Directional drilling involves sinking boreholes at an angle to intersect at a predetermined depth, where fuel is ignited.

Electrolinking, the first phase in the method of gasification tested by the Missouri School of Mines, channels between boreholes with electric current. Subsequent phases of the underground electrocarbonization process are electrocarbonization (coking), and electrogasification (the process whereby residual coke formed during coking is recovered by means of conversion with air, oxygen, steam, or a combination).

Unique feature of this process, of course, is the use of electric current passed between electrodes sunk into boreholes to open a passage for gasification.

Results of Field Tests

After laboratory experimentation, begun in 1947, full-scale electrocarbonization field tests were held from June 1948 to June 1951. The field tests verified the laboratory results. Linking was effected easily for distances greater than 20 ft, and 150 ft may prove to be practical. At the recent Gorgas test, linking was successfully done at distances of 67 ft between electrodes.

Gas taken out during the coking stage was found to have a maximum heating value of 600 Btu per cu ft. After carbonization, residual coke was gasified by the introduction of air to obtain producer gas. A sample taken five hours later showed a heating value of 263 Btu per cu ft, which is somewhat higher than normally can be expected because of incomplete coking.

Electrocarbonization seems to be a solution to most gasification difficulties, since the short-duration electric heating (electrolinking) can be extended through a necessarily longer time (electrocarbonization) to ideally prepare a fuel bed for complete conversion. Further, all ash and waste material are left below the surface.

Similar Success at Gorgas

Results at Gorgas recently, using the same electrical equipment used by the Missouri School of Mines, indicate that by continued operation or modification, excellent producer gas can be produced. During the 44 days that gasification continued, gas recovered averaged 186 Btu per cu ft, and varied from 80 to 300 Btu. The test also seemed to clearly demonstrate that such production can be economically justified.

How to Size Piping and Valves for Flashing Mixtures

By W. F. ALLEN, Jr. Stone & Webster Engineering Corp.

FLASHING MIXTURES of water and steam may occur in circuits of extraction feedwater heaters, boiler blow-off lines and other power plant equipment. Unless the piping and valves are properly sized for such mixtures, they may cause pipe and valve erosion, may reduce flow capacity and produce other troubles.

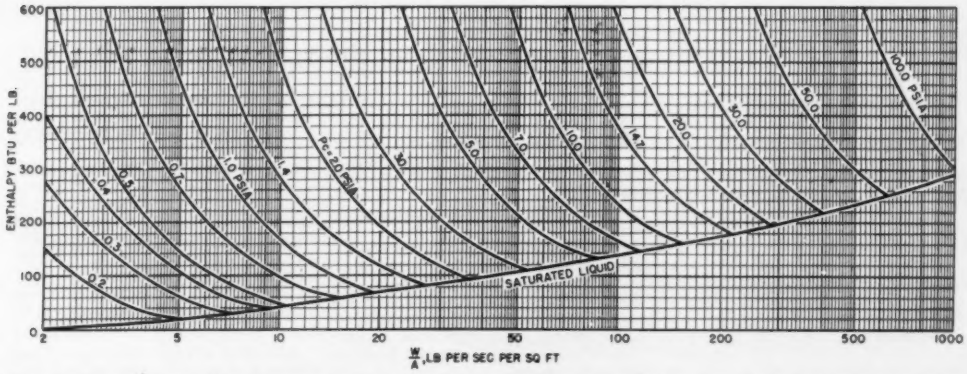
In the May issue, the author showed suitable formulas for the design of such piping and valves to minimize erosion and secure desired flow.

A numerical example was worked out as shown in Table III, page 61, May issue, for a flow of 90,000 lb per hr in a specific installation. After completion of the article, the author also submitted the attached chart.

It reduces computation labor in sizing the piping and valves. The author carried out a number of calculations and plotted them as the saturated liquid line on this chart. In addition, he calculated critical pressures for an enthalpy range of 0 to 600 and rates of flow per unit area (W/A) for a range of 2 to 1000 and these are all plotted on the accompanying chart. Hence the required area can be obtained more easily from this chart than from the computations of Table III.

For the example of Table III, page 61, May, the chart gives the answer as follows: the intersection of the 196 Btu enthalpy corresponding to the 20 psia saturation pressure with the saturated liquid line gives the rate of flow per unit area W/A as 283 lb per sec per sq ft. Hence if W = 90,000 lb per hr or 25 lb per sec, then A = 0.0885 sq ft or 12.7 sq in. By computation as in Table III, values are 12.7 to 12.9.

In the June issue, a second article by the author showed the factors involved when flashing occurs at the control valve and showed on page 84 a handy chart from which the size of control valve can be quickly found. Here, too, the pipe exit critical pressure chart is useful. On page 85, June, column 1, line 6, let the sentence read: "The pressure drop in the piping from the control valve to the receiver can be determined by using the pipe exit critical pressure chart or formula 2. . . ." and so on.



Pipe exit critical pressure chart for water-steam mixtures, by W. F. Allen, Jr., for direct reading of W/A in sizing piping Table III, page 61, May issue

LETTERS TO THE EDITORS

Brickbats on Smoke

REFERRING to page 69, May issue, New Slants on Smoke, the writer of this article, Paul A. Dobbs, owes the stationary engineers of this country an apology. To my way of thinking, stationary or power engineering is a high and most respected profession, and I am proud to be in this line of endeavor for more than 52 years.

I take exception to this remark of Mr. Dobbs' ". . . Most men who are associated with industrial power plants and steam plants will agree, although some will dissent, of course, that the average stationary engineer, fireman or boiler operator has more fear of getting a smoke notice than of poor combustion practice. As a result . . . there is a tremendous economic loss due to poor combustion practices, . . ." and so on.

The stationary engineer does not fear a smoke notice and will not sacrifice economy in fear of the smoke notice. He is a respectable citizen in his community and is not a coward and he has done a great deal to eliminate the smoke nuisance.

Mr. Dobbs also says "The average plant that hires just average combustion control men (stationary engineers) gets just what it pays for. The average stationary engineer is not well informed on the items of his work that require mental vision. He sees cast iron and coal but seldom looks through the cast iron and coal to what it could mean to him. In few places in an industrial plant is the possibility of savings as great as the boiler room, yet it is the most neglected."

This is the most contemptible statement I have ever read in an engineering magazine in all my life. This article is studiedly contradictory and slanderous to the many competent stationary engineers throughout the country.

Brooklyn, N. Y. PETER J. GILLEN

Dobbs Answers Gillen

IN YOUR third paragraph you state:

1. ". . . The stationary engineer does not fear a smoke notice":

Any engineer who does not fear a smoke notice has somebody other than himself to answer before the Smoke Board for the fireman's smoky operation. Any engineer who has to face the Smoke Board will not consistently disregard that Board's notices.

2. ". . . will not sacrifice economy in fear of smoke notice":

The decision to sacrifice economy is not made as such; the operator merely increases the air supply to avoid smoke and does not give much thought to ways to avoid smoke by other more involved means.

3. ". . . is not a coward":

There is no question of a man being a coward in deciding what type operation he performs; it's a question of information, not character.

4. ". . . has done a great deal to eliminate the smoke nuisance":

It appears that the only way smoke elimination has been even partially obtained in certain areas has been through the civic bodies of such areas, not by any action on the part of any organized group of stationary engineers, as evidenced by Mr. McCabe's very excellent, and helpful article in the June *National Engineer*.

There was no intention to criticize the jet stack. It is much better in all ways. It does, however, have different smoke proportions than the older large diameter natural-draft stack and it is mentioned only so that the difference can be noted in Smoke Board calculations of smoke emission.

Your fifth paragraph alleges slander. There is no such intention. There *are* many competent stationary engineers, fine men and a real credit to their community. There is no question but that the complainant is one of the men who worked, slaved and suffered through the period when boilers and furnaces were growing up through a most difficult period. These men were all-around operators and could do anything that the department required. They kept the plant running through thick and thin finances, worked as many hours as was necessary and beyond; and by their labors expressed a loyalty to employers not seen as often today.

Chicago, Ill. PAUL A. DOBBS

Is the Jet Stack Blacker?

I BELIEVE Mr. Dobbs' statement, that smoke from a small stack looks darker than from a large one, is wrong. It seems to me that the article has considered velocity and density as the same thing and has ignored the thickness of the column.

For an excellent explanation, see Inadequacy of the Ringelmann Chart by Lionel S. Marks, page 681, September 1937 *Mechanical Engineering*.

Also, see Theoretical Analysis of Smoke-Column Visibility, by H. D. Bruce, February 1, 1941 *Journal of Agricultural Research*. The latter article was written from the point of view of discovering forest fires and shows that, among other factors, a large column of smoke looks darker than a small one of the same density per unit volume.

Louisville, Ky. F. S. CARPENTER

Waite Protests, Too

I TAKE EXCEPTION to the May article by Paul A. Dobbs.

It is very evident that the stationary engineer does not rate very high with Mr. Dobbs, in spite of the fact that the average stationary engineer today is holding a position of responsibility comparable to any group.

I do not concur that engineers use poor combustion to save a summons, at the same time keeping a blanket over the head of the owner insofar as his operating expense is concerned. The fact remains, however, that when, as this article claims, the owner is entitled to good operating practice, the stationary engineer goes to the owner with recommendations for improvement, many times these recommendations don't get full consideration.

Stationary engineers will appreciate a retraction from the statement that they see cast iron and coal but seldom look through the cast iron and coal to see what it means to them.

New York City HARRY A. WAITE

A British Booster

MANY THANKS for your recent letter and copies of your magazines.

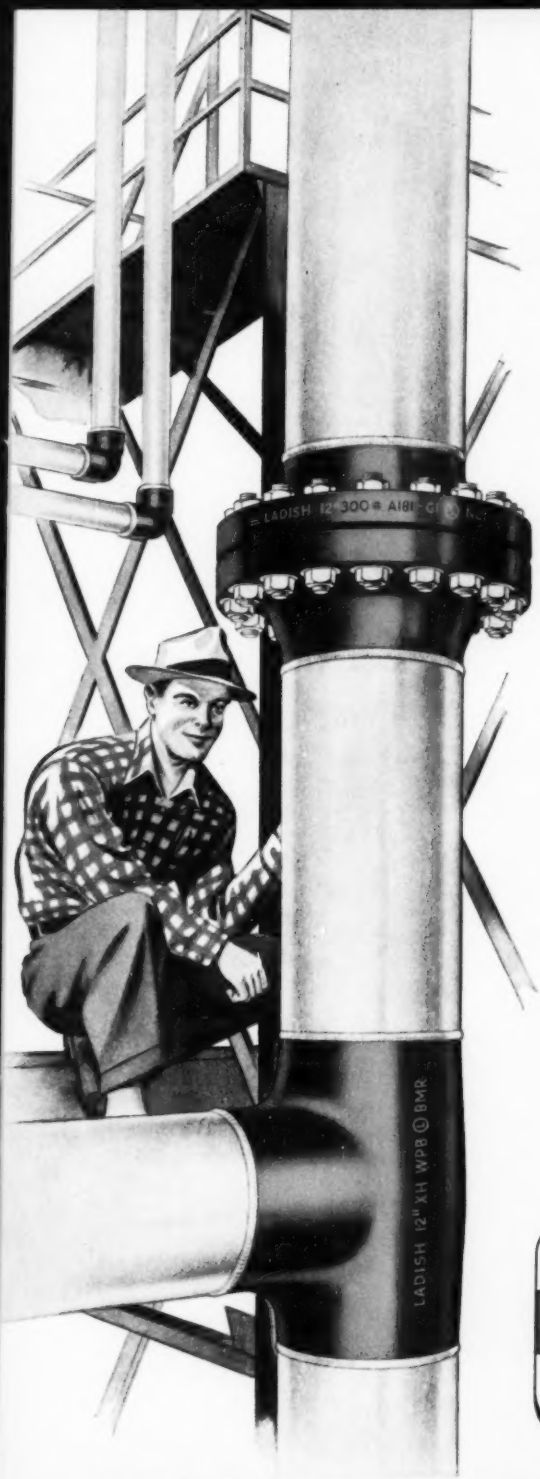
Your letter awakened nostalgic memories of a very happy evening I spent with your editors at the University Club, Chicago on February 12 of this year where the Heat, Fuel and Energy Productivity Team were the guests of POWER ENGINEERING (see April issue, page 7). A wonderful dinner was served and the convivial evening that followed was equally grand. I am still telling some of the stories I heard. I retain as a memento some very fine photographs taken in honor of the occasion. If you care to check up, I am the fine looking fellow seated on the floor, extreme right, in the large group. (April page 7.)

My company is the largest brewing concern in the British Empire. Romford Brewery is not their largest, but we are very efficient. For your interest, I enclose an article on our new boiler plant (from *The Steam Engineer* of London).

I have been very busy writing reports and articles for the technical press ever since my return and, believe me, I keep rooting for Uncle Sam all the time. You are away ahead of us in most things, but it is somewhat of a consolation to think that we, the British, had quite a lot to do with the founding of your nation.

JNO. HALL

Mr. Hall is Chief Engineer of Ind Coope & Allsopp Limited at Romford, England, a suburb of London.



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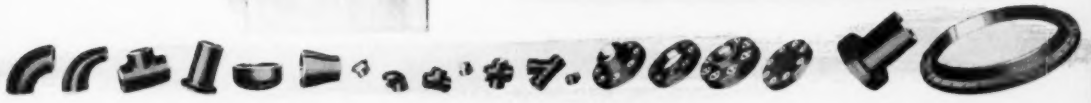

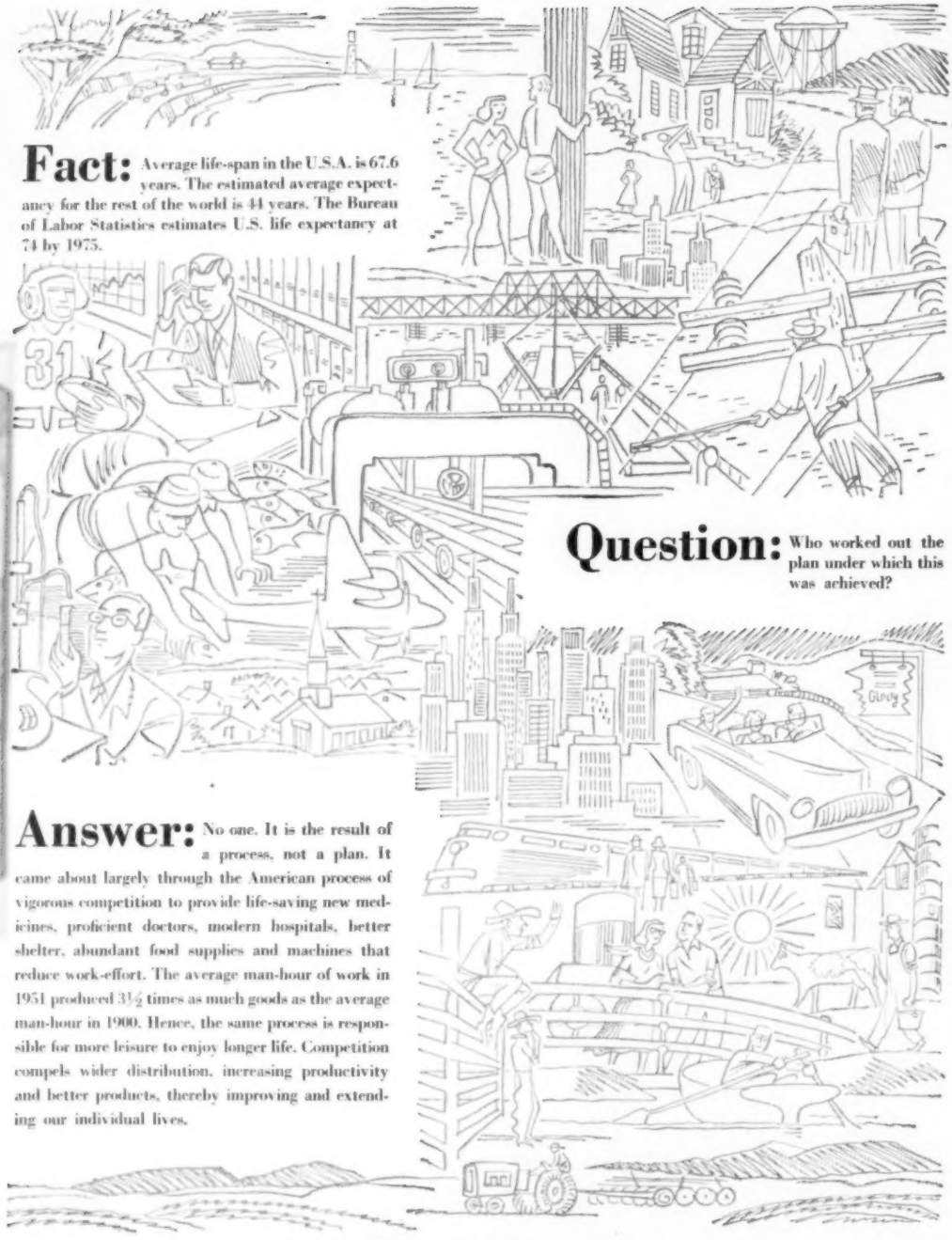

Fact: Average life-span in the U.S.A. is 67.6 years. The estimated average expectancy for the rest of the world is 44 years. The Bureau of Labor Statistics estimates U.S. life expectancy at 74 by 1975.

Question: Who worked out the plan under which this was achieved?

Answer: No one. It is the result of a process, not a plan. It came about largely through the American process of vigorous competition to provide life-saving new medicines, proficient doctors, modern hospitals, better shelter, abundant food supplies and machines that reduce work-effort. The average man-hour of work in 1951 produced 3½ times as much goods as the average man-hour in 1900. Hence, the same process is responsible for more leisure to enjoy longer life. Competition compels wider distribution, increasing productivity and better products, thereby improving and extending our individual lives.

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Leader Says It Will
No, If Leak-proof; Yes In Practice, Says Lacey
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Water Treatment Engineering—
Why Water Is Impure

By L. W. FITZPATRICK

Water treatment forms a major step in steam and power generation today. Yet, too often, discussions of water treatment deal with quasi-theoretical data of doubtful help to the operator. In most cases he wants to know how things are done, as well as why. Beginning in this issue, a series of short articles on Water Treatment Engineering, by L. W. Fitzpatrick, will be devoted to practical descriptions and explanations of how water is handled and treated from the moment it first enters a power plant. This first article, which is purposely elementary and introductory, explains the necessity for water treatment. Future articles will discuss in detail such subjects as scale, conservation of water, water tests and short cuts, cooling towers, physical arrangement of water treatment equipment.

HARDLY any section of the world has a raw water supply that cannot be adapted and adjusted for use in power and thermal equipment. In the early days after Watt's invention of the steam engine with its companion steam boiler, little attention was paid to water. Scale accumulated without excessive tube losses and outages, but continuous cleaning of power boilers was a necessity.

Today's constantly mounting steam pressures and rising temperatures materially advance the science of water conditioning, and laboratories exploring the behavior of water at high temperatures bring forth never-ending improvements of formerly accepted methods of scale and corrosion control.

The irrefutable fact, that use of a controlled water treatment program saves expense and back-breaking labor of cleaning power equipment, makes a knowledgeable and common-sense approach to water treatment a must for power and process plant engineers everywhere.

What Is Raw Water?

Nature never produces pure water. Source of all water supply, of course, is rain, snow, sleet or hail falling through the atmosphere where it dissolves soluble gases, mainly carbon dioxide and oxygen, along with other impurities in the form of dust.

After reaching ground level, decaying vegetation furnishes additional carbon dioxide concentrations, accelerating the now acid state of the original water as it trickles through the soil or remains on the surface in streams, rivers and lakes. Continued atmospheric exposure rapidly saturates surface water with dissolved gases hastening the decomposition of suspended surface materials. With carbon dioxide (CO_2) in solution, raw water (H_2O) is in reality a weak acid: $H_2O + CO_2 = H_2CO_3$.

Rocks of complex chemical formula, limestones and feldspar particles, are constantly being decomposed, and ground water in its acidic form continually takes into solution varying amounts of aluminum, magnesium, sodium, potassium and iron salts.

Since most of this rock formation was formed many centuries ago, partly from contact with sea water, variable amounts of mineral substances, such as sodium chloride or other metallic chlorides, can be imparted to the raw water.

Thus, it can be seen that the less contact natural water has with soil, or the more insoluble matter in its path, the smaller the amount of dissolved mineral compounds it will acquire. Similarly, the shallower the source of supply, the smaller the mineral content due to time and opportunity to dissolve minerals.

Kinds of "Hardness"

Calcium carbonate ($CaCO_3$) and magnesium carbonate ($MgCO_3$) are the principal ingredients of limestone, and finely divided particles of these substances exist throughout the earth.

Raw water (H_2CO_3) decomposes calcium and magnesium carbonate to form:

$CaCO_3 + H_2CO_3 = Ca(HCO_3)_2$ (Calcium bicarbonate), and

$MgCO_3 + H_2CO_3 = Mg(HCO_3)_2$ (Magnesium bicarbonate)

These compounds in supplies of raw water are more familiarly known as "temporary hardness" or carbonate hardness, since the dissolved bicarbonates are readily broken down by heat to revert to their natural state:

$Ca(HCO_3)_2 + Heat = CaCO_3 + H_2O + CO_2$

The reaction is identical for magnesium and other bicarbonates. When raw water of this nature is used in a boiler without adequate chemical control, a relatively soft boiler scale forms.

When ground waters contact calcium sulfate, known as mineral gypsum ($CaSO_4.2H_2O$), found in extensive massive form and often in crystalline deposits such as alabaster, selenite and satin spar, some of the calcium sulfate dissolves to give raw water a "permanent hardness" or non-carbonate hardness, since it cannot be removed by application of heat.

Raw water, without chemical treatment, makes control of thermal equipment a serious problem because calcium sulfate is precipitated to form a dense, compact boiler scale.

Successful water softening must remove both calcium bicarbonate and calcium sulfate, as well as corresponding magnesium salts. The latter are

ABOUT THE AUTHOR

Lawrence W. Fitzpatrick has been "in and around" water all his life. Beginning many years ago in a bridge gang at Rock Island, Ill., he became foreman at 19; later a bridge designer; finally a bridge and general contractor.

He has been active with thermal power machinery of many types—from a "one-lung" steam hoisting engine (which, incidentally, replaced three mules) to equipment operating under water. During World War I he directed fabrication and construction of undersea warships at a submarine boat yard.

Mr. Fitzpatrick was supervising engineer for the State of Missouri during WPA-PWA days. In World War II he was in Mexico engaged in design and construction of specialized water purification systems for the Mexican Railroad Company.

He is now Chief Engineer for the Missouri Department of Corrections at Jefferson City, Mo., and in this capacity has had experience with all types of power equipment and water in Missouri's prisons and other institutions.

LAWRENCE W. FITZPATRICK

Chief Engineer

Department of Corrections,

State of Missouri

Table showing common impurities found in raw water and the objectionable conditions which result

Impurity	Condition It Causes
Carbon Dioxide	Accelerated corrosion in steam and return condensate lines
Oxygen	Pitting in steam and return condensate lines
Hydrogen Sulfide	Steam line corrosion. Objectionable taste and odor to raw water
Suspended Matter	Sludge and scale deposits
Mineral Acids	Corrosion in steam and return condensate lines
Oil	Scale and boiler foaming
Calcium Salts	Hard scale
Magnesium Salts	Soft scale
Silicates	Extremely hard scale especially at high pressures
Iron	Scale and "red" water

also a source of hardness, though they appear in much smaller quantities per volume of raw water.

Raw Water Characteristics

Surface waters from lakes, streams, artificial ponds, cisterns and rivers, when not polluted by industrial wastes, have a lower mineral content than well waters. This is especially true in locales where flows contact insoluble rock formations, thus avoiding heavy dissolution of minerals.

Most industrial supplies are obtained from shallow and deep wells. Because of the filtration effect of passage through porous strata, rain water acidity is neutralized by mineral earth oxides and suspended matter is removed from the raw water.

A deep well is often spring-like in its action — primary difference being that springs form from water percolating the earth's strata until it reaches a defective fault layer. In the case of a well, water accumulates at the impervious stratum until tapped for industrial or home use.

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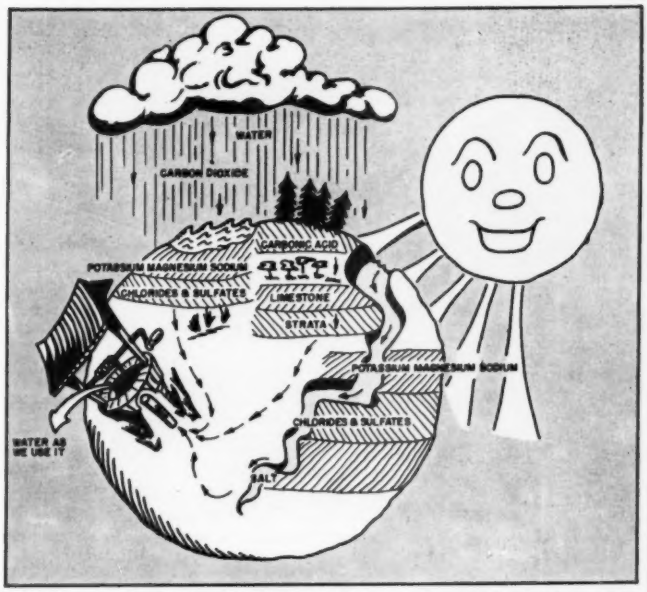


Water, from source to use, is exposed to substances which impart to it many and varied characteristics

Both well and spring waters are therefore quite similar in the amount of dissolved solids composed of carbonates and sulfates they contain. Deep wells produce strongly alkaline water from sodium carbonate content. This is the result of zeolitic action when ground water passes through natural zeolite beds at one time or another, thus having some of its calcium and magnesium carbonates changed to sodium carbonate by mineral base action.

Well waters have been known to be hard and contain calcium and magnesium carbonates and sulfates at one stage or level, and at some lower level become soft and alkaline.

Due to underground drainage many smaller streams now have characteristics identical to those of smaller wells. This is more pronounced during dry months of the late summer and fall. Therefore, mineral content of water in these smaller streams can vary inversely as the volume of water varies up and down.

Any water will vary from time to time in its composition and frequent check analyses are necessary to make suitable adjustments in treatment. Most well and spring waters are definitely affected by rainfall, strongly influencing these variations.

Composition Not Constant

Normal supplies in time of drought may be diluted by water forced in from different sources. Water character then is completely changed. Normally, rainfall would furnish the bulk of the supply, diluting any objectionable minor part of the well water. During drought periods dilution from other sources results in even larger concentrations of objectionable materials.

Value of water for industrial purposes depends, therefore, on the kind and amount of dissolved mineral substances. Treatment operation and adjustment based on the *original* source of the water and its analysis will have little practical value in day-to-day plant operations.

National Power Show to be Held In New York December 1 to 6

TWENTIETH National Exposition of Power and Mechanical Engineering will be held in Grand Central Palace, New York, December 1 to 6, next. It will be held again under the auspices of the ASME, whose annual meeting will be in session during the same week, thus assuring a large attendance of professional men.

As heretofore, the biennial event will include exhibits representing every kind of equipment used in the generation and distribution of power, with specific applications in many new and more efficient ways. There will be upwards of three hundred different kinds of products on display, occupying three entire floors of the Palace.

The National Power Show was founded in 1922, and consequently is celebrating its 30th anniversary this year. Seventeen of the 19 previous displays were held in Grand Central Palace, but during the world war that structure was occupied by the military, forcing the temporary migration of the show to Madison Square Garden.

Management of the Power Show continues under the International Exposition Co., with permanent headquarters in the Palace. Charles F. Roth is manager of the exposition. E. K. Stevens is associate manager.

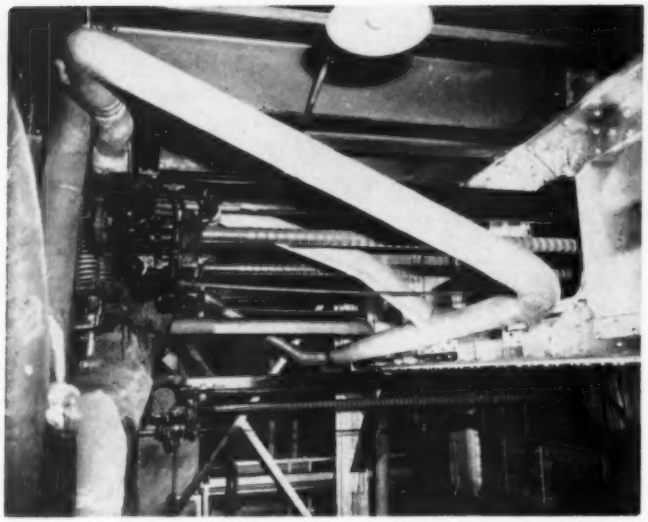


Fig. 1. Installation showing retractable air-motor-driven soot blower elements blowing 400-psi steam

Steam Piping For Soot Blowers

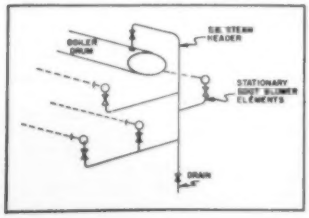
High pressures and temperatures of modern steam generators make the design of soot blower installations a complicated job. Piping for these installations, says the author, can be the trickiest

By HENRY de SOTO, Associate Engineer, Coxe Engineering Co.

ONLY A SHORT time ago engineering of soot blower systems was a relatively unimportant segment of plant design and construction. Often installation and design were delegated to almost anyone, however meager his knowledge of engineering or construction. But today, with the tendency toward higher pressure and higher temperature steam generating units, soot blowers demand engineering attention of the most proficient degree possible.

Simple valve-in-head type blowers, of course, will continue to serve low-pressure steam-generating units. A perennial for use with boilers with pressures up to 300 lb, piping for this type of blower is basic enough to qualify almost every fitter for its erection. Elements are generally of chrome or nickel-steel alloy which, because of continuous exposure to fire, constantly require replacement. Fig. 2 shows a typical arrangement for a valve-in-head soot blower.

Fig. 2. Typical piping arrangement of valve-in-head soot blowers for a boiler under 300 psi



Within a comparatively few years after the advent of higher pressures and temperatures — with a corollary need for more practical, better performing and more durable soot blowers — retractable and gun type blowers were developed. A retractable soot blower is shown in Fig. 1.

Although affording much more efficient service in the power plant, use of these newer type blowers raise some controversial questions. It becomes important to know: Is steam more economical than compressed air? Is sequential operation the method to use today? How to design soot blower systems in intricate, modern plants?

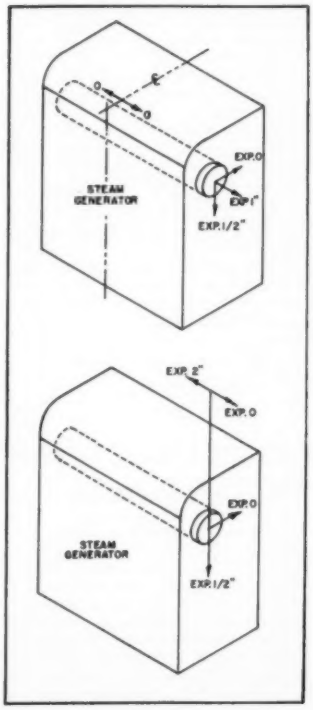
Piping For Soot Blowers

This article will confine itself generally to a discussion of the significance of engineering and design to steam piping for soot blowers. Modern design of such piping for a high pressure (1900 psi) and temperature (1000 F) unit is shown in Fig. 4.

One highly acceptable arrangement of steam piping for soot blowers, as illustrated, has the source emanating from an intermediate pressure-temperature header — in this case, the attemperator header. A gate valve at this source, plus a motor-operated gate controlled from the boiler control board, provides a simple means of controlling steam to the blowers. For sequential operation the motor-operated gate valve is controlled from the sequential panel. This method gives singular blowing in a chain procedure: that is, after one soot blower operates, another starts at a predetermined timed interval. When all blowers have been operated the sequence ends.

From the motor-operated valve semi-high pressure steam, often 800 psi, travels into a pressure reducing station without temperature reduction since the temperature of the reduced-pressure steam is still low enough for satisfactory operation. The pressure reduction station, as shown in Fig. 4, consists of a manually operated gate valve, a pressure reducing valve of the angle type, followed by another manually operated gate valve. Many times a manually operated emergency pressure reducing station serves as a by-pass in the case of pressure-reducing valve failure.

Fig. 3. Two cases of steam generator expansion which may be bilateral or vertical, or both



Such an emergency station consists of one gate valve at the inlet and a globe valve at the outlet, or in some cases both can be globe valves. Throttling of the valves causes pressure reduction. However, modern practice dictates pressure reduction stations of the pressure reducing valve type for more exactitude. After being reduced in pressure, by either method, the steam is of proper condition for use in soot blowers.

Complicated Piping

Piping for such a system is another matter, and a complicated one. It presents many problems of engineering, design and selection of material to ensure satisfactory functioning. Even mundane matters such as hanging, guiding, anchoring and toggling are a challenge to engineering-design resourcefulness. Numerous cases of line failure are directly traceable to poor engineering design.

The piping system, like that shown in Fig. 3, demands the selection of piping, fitting and valve materials of suitable characteristics to withstand the high pressure and temperature of the steam until it is reduced at the pressure reducing valve. After that point, specifications of the system are governed by the pressure attained and the consequent temperature reduction. Nature of these requirements are invariably of a lower quality and hence lower cost.

Since the steam line and steam generator "breathe", design of the piping system for soot blowers must provide allowance for expansions of a complex nature — bilateral as well as vertical. The generator, for example, may expand from its center toward both ends; or it may move in its entirety from one end to the other, as shown graphically in Fig. 3.

At point A in Fig. 4, boiler tubes to which the soot blower end is attached move 4 in. down, and as much as 1 in. and 2 in. respectively at right angles on a horizontal plane. Point B, therefore, must be set 4 in. lower to allow for this expansion, plus 1-in. more to ensure proper drainage of the pipes. Then, when the boiler connection moves downward 4 in. the soot blower element will remain nearly horizontal, except for the drainage slope. This condition, plus the normal thermal expansion of the vertical steam headers to which the blower system steam branches are connected, complicates piping design to the extent that necessary elevations must be arranged to avoid condensate pockets from forming.

Along with careful planning of the steam header for well balanced vertical expansion (by wise selection of anchoring points), it is necessary to account for the expansion of individual branches. Most convenient method acceptable is to connect each branch to a vertical header at a point where the requirements for hanging will not exceed permissible expansion limits for small helical springs. Pipe hangers were shown in a previous issue.

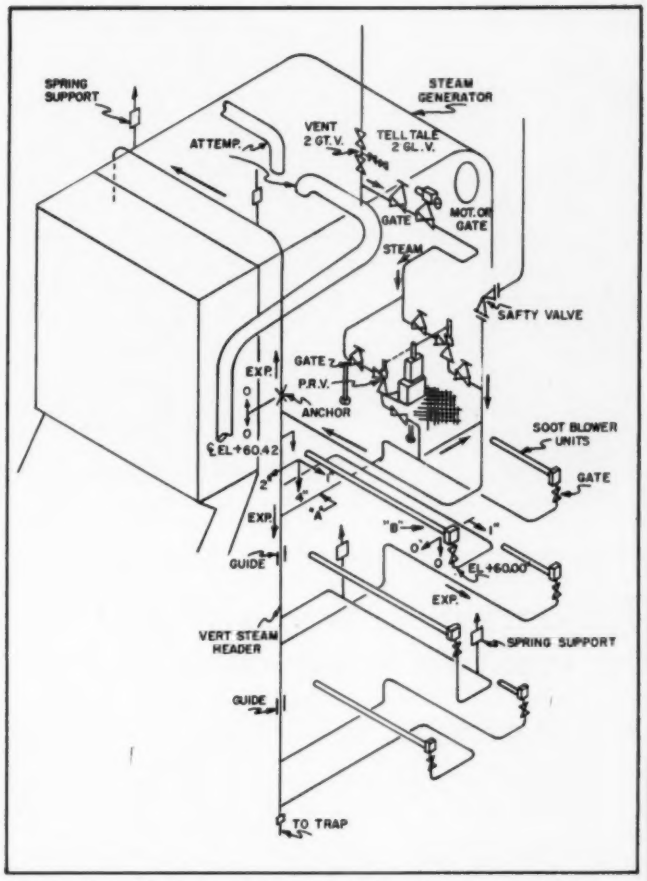


Fig. 4. Soot blower piping for a modern high pressure (1900 psi), high temperature (1000 F) boiler

Ohm's Law Made Easy

IN ELECTRICAL WORK three factors are always involved. These are: the potential E measured in volts; the current I measured in amperes; and the resistance R measured in ohms. The relation between these three quantities is shown by the first line of the accompanying formula. With direct-current, where power factor is not involved, the basic formula for the power loss W in watts is the product of volts and amperes. This combined with Ohm's law makes it possible to develop 9 separate relations between various combinations of the four quantities E, I, R and W. These are also shown by the three lower rows of formulas. Thus when a 20 ohm resistor is shorted across a 6-volt circuit the current flow can be found as follows:

$$I = E/R = 6/20 = 0.3 \text{ amps}$$

Similarly the power used would be:

$$W = EI = 6 \times 0.3 = 1.8 \text{ watts}$$

If the current was of no interest, the watts could be found direct from the voltage and resistance by using the first formula in the bottom line. The heating effect or loss due to resistance is what determines the carrying capacity of a conductor for a given voltage drop.

$I = \frac{E}{R}$	$R = \frac{E}{I}$	$E = I \times R$
$W = E \times I$	$E = \frac{W}{I}$	$I = \frac{W}{E}$
$W = I^2 \times R$	$I = \sqrt{\frac{W}{R}}$	$R = \frac{W}{I^2}$
$W = \frac{E^2}{R}$	$R = \frac{E^2}{W}$	$E = \sqrt{R \times W}$

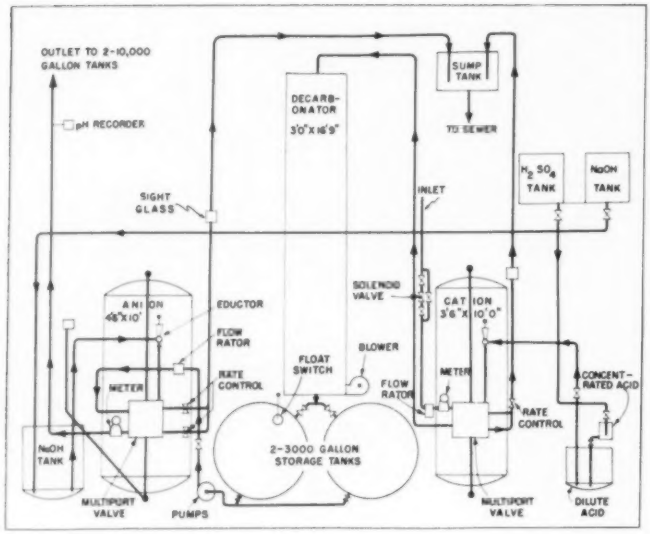


Fig. 1. Silica-removing deionization unit in the Central Iowa Power Co-operative's Prairie Creek plant

Deionization Saves 17% In Treating Feedwater

USE OF a silica-removing deionization system instead of distillation equipment is producing savings of about 17 per cent in the cost of treating feedwater for the Iowa Electric Light and Power Co. of Cedar Rapids.

Installed at the Prairie Creek power station of the Central Iowa Power Co-operative and operated by Iowa Electric Light and Power, the two-stage system is meeting severe requirements in conditioning raw water which is high in both ionized solids content and hardness. In addition, the system is performing the very important job of removing silica and carbon dioxide.

The deionizing equipment was specified to operate in conjunction with evaporators in preparing makeup feedwater for high pressure boilers. However, a rapidly increasing demand for power in the area necessitated advancing the date for initial plant operation, with the result that the deionizing system was put into service, and the boilers placed on the line, before evaporators had been completely installed. The power plant continued in full operation for more than 3 months before a trial run on the evaporators was even begun. Meanwhile, performance and operation of the deionization system proved satisfactory, and the evaporators have not been used.

In order to condition up to 3.5 per cent makeup for 2 boilers operating at 850 psi and 950 F. the two-stage system delivers a flow rate of 40 gpm. The raw well water has a total ionized solids content of 414 ppm as calcium carbonate, a hardness of 301.8 ppm as $CaCO_3$ and a silica concentration of 12.0 ppm as SiO_2. Treated water averages less than 1.1 ppm in total ionized solids, a quality equivalent to an electrical resistance of approximately 300,000 ohm-cm, with zero hardness and a silica concentration of less than 0.1 ppm. Average cost savings, in comparison with distillation, are approximately 17 per cent.

The installation, Fig. 1, includes a cation exchange unit $3\frac{1}{2}$ ft in diam and 10 ft high, an anion unit $4\frac{1}{2}$ ft in diam and 10 ft high, and a single degasifying tower for removal of carbon dioxide. The cation unit contains a 51 cu ft charge. In the anion unit, a bed containing 47 cu ft of Amberlite IRA-400 is removing not only silica but also any traces of CO_2 missed by the aerator. IRA-400 exchanger is the strongly basic synthetic anion exchange resin developed in 1948 by Rohm & Haas Co.

About 2.1 lb of caustic are required for regeneration of the anion exchanger for each 1000 gal of water treated. For the quality of water employed, this amounts to 0.88 lb of caustic for each kilograin of solids removed, calculated as $CaCO_3$. Between regenerations, the anion exchange unit is able to condition 120,000 to 130,000 gal of water before significant silica break-through.

Each cation exchange unit is able to condition 21,000 to 23,000 gal between regenerations, and requires about 5.2 lb of regenerating acid for each 1000 gal of water treated. For each kilograin of solids removed by the cation exchanger, 0.29 lb of acid are required.

Additional Benefits of System

According to the chemical engineer supervising the installation, these units have been run to their capacity only once, when they were found to be well within their guaranteed specifications. In no case has resistance of the water fallen below 100,000 ohms. Only very seldom has even a trace of silica been found. The pH values lie between 9.0 and 9.8.

Collateral benefits include production of treated water of consistently high quality in spite of wide variation in the quantity required. This variance, of course, cannot be tolerated in normal operation of evaporators. Also, week-end shut-downs present no problem. Comparatively, the first cost of equipment was low. Cost of treatment by deionization is also less than that by evaporation, particularly in view of heat losses suffered through evaporator blowdown and the waste of energy in the evaporator as pressures are lowered. Maintenance costs, too, are reduced because carbon dioxide, never completely removed from water after evaporation, is no longer present to corrode piping.

Capacitors Save $150,000 a Year

ANNUAL 50,000,000 kwh power loss reduction, representing an estimated savings of approximately $150,000, has resulted from the installation of 142,000 kvar of capacitors in the Pacific Power & Light Company's.

In a power factor improvement program, the PP&L installed one kvar of capacitors for every 2.43 kw of its 345,000 kw peak-load capacity.

The capacitor installations, many of which were supplied by the General Electric Co., increased the utility system's power factor to an estimated 97 per cent in 1950.

At 3 mils per kwh, the reduction represented an estimated annual saving of about $150,000. Annual cost of carrying the 142,000 kvar of capacitors was figured at $142,000 ($8 per installed kvar capitalized at $12\frac{1}{2}$ per cent), or $8000 less than the annual saving resulting from the installations.

The utility also noted that the capacitors reduced the voltage drop in overhead circuits by 23 to 48 per cent and released approximately 15 per cent capacity in cable, regulators and transformers.

New Electromagnetic Pump Has No Moving Parts

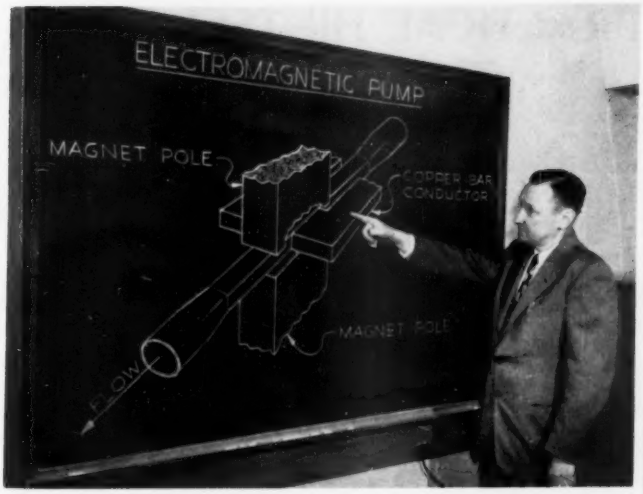


Fig. 1. Dr. Arthur H. Barnes, Associate Director, Division of Reactor Engineering, Argonne National Laboratory, is pointing to a schematic drawing of the new electromagnetic pump which he helped develop

DIRECT-CURRENT electromagnetic pump which has no moving parts and which is capable of pumping large quantities of liquid metals at a rapid rate of flow has been developed at Argonne National Laboratory, Chicago, Ill.

Arthur H. Barnes, Associate Director of the Laboratory's Reactor Engineering Division, Fred A. Smith, and G. Kirby Whitham developed the device. It is being used to pump a liquid metal coolant through the Laboratory's Experimental Breeder Reactor at the Atomic Energy Commission's National Reactor Testing Station in Idaho. Argonne scientists, using this reactor, produced the first known electricity from atomic energy on December 20, 1951 (POWER ENGINEERING, February, 1951).

Since the pioneer work of Northrup in 1907, many investigators have developed a wide variety of apparatus for pumping liquid metals by electromagnetic means. In 1928, an alternating current electromagnetic pump was patented by Albert Einstein and Leo Szilard. Present interest in liquid metals as reactor coolants has served to spur development of pumping equipment capable of handling such materials at high temperatures and in the presence of large quantities of intensely radioactive materials.

The pump developed at Argonne consists essentially of a straight piece of tubing, two copper bars, and an electromagnet. Tubing is thin-walled stainless steel or nickel-chromium alloy pressed into a rectangular cross section. Heavy copper bars are silver soldered to opposite sides of this tubing. The assembly is then placed between the poles of an electromagnet and inlet and outlet pipes are attached to the tubing, as shown in Fig. 1. An electrical current entering the wall, passes through the liquid, and develops in it a longitudinal thrust.

Electrical current used is 20,000 amp at one volt. Because of this low voltage drop, insulation problems are practically non-existent. This is a very desirable feature inasmuch as high temperature and radiation would tend to affect pumps which require insulation. The pump can run continuously with liquid metals at a temperature of 750 F.

The Argonne pump is a completely sealed all-metal system. Since it has no moving parts, there are no bearings to wear or require attention. This is particularly advantageous where material being pumped has become radioactive. Because it has no moving parts and operates on direct current, it is completely free of vibration.

Pumps of greater capacity (several thousand gpm) can be constructed by scaling up the equipment and increasing the amount of current used, according to the designers.

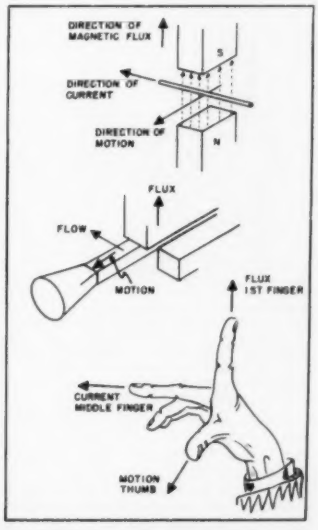


Fig. 2. Sketch which illustrates the application of the right-hand rule used to explain motor action

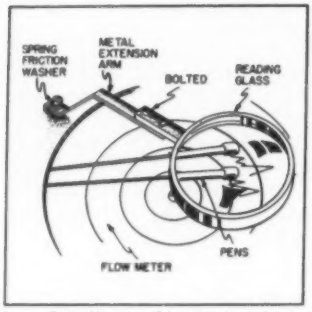
Editor's Note: Those familiar with elementary electrodynamic theory will easily recognize the principle involved in the operation of this pump. It is the same principle embodied in the operation of an electric motor, and the direction of flow can be determined by means of the familiar right-hand rule. It will be noted that the direction of the magnetic flux, the direction of current through the liquid metal in the tube, and the direction of flow of the liquid metal are all at right angles, just as are the components of emf, motion of the conductors, and direction of magnetic flux in an electric motor. In the electromagnetic pump the conductor is the mass of liquid metal in the tube, free to move as a result of the interaction of the magnetic field due to the magnetic poles and the magnetic field surrounding elements of the liquid metal as a consequence of the current flowing through it

PRACTICAL HINTS AND KINKS

Easy Reading Flowmeter

By JOHN FOSTER

BY ATTACHING an inexpensive magnifying reading glass to the cover door of a flowmeter, as shown, readings of the indicating pens can be



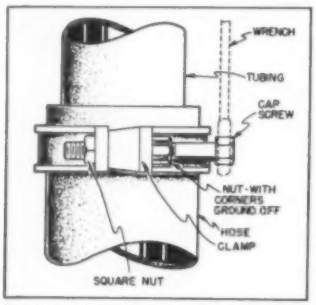
A way of attaching magnifying glass to read meter

readily determined at any time simply by moving the lens to the desired position.

Heavy Duty Hose Clamp Bolt

By CARL THOMAS

RUBBER HOSE employed to connect tubing carrying refrigerating gas under moderate pressure could not be clamped tightly enough to prevent leakage of the gas, because the slotted



How to use hexagon nuts for a tight connection

head screws used with the hose clamps could be tightened only to a limited extent with a screwdriver.

This difficulty was overcome, however, by substituting hexagon head cap screws as shown. Since there was not sufficient room on the clamp to permit rotation of the hexagon head of the cap screw, a second hexagon nut, with the hexagon corners ground off, was threaded onto the cap screw to the end of its thread. Then, by turning the head of the cap screw with a wrench, the screw could be tightened in the regular square nut at the opposite end of the screw (which was held from rotating by the shape of the hose clamp end) and considerably more pressure could be imposed on the clamp.

Detecting Ammonia Leaks

AMMONIA LEAKS can often be located readily in a quiet cooler by sound — an especially valuable method when the fumes are so strong that the usual methods of detecting leaks are difficult to apply. Small leaks can also be detected often by smell, although sulphur candles or sulphur sticks are more convenient and reliable as to exact location. After the approximate location has been found by either method the exact position of the leak may be determined by applying a coat of oil or by coating of thick soapsuds and watching the formation of bubbles.

When burning sulphur is brought in contact with ammonia fumes a very noticeable smoke or cloud is produced. Sulphur sticks used for this purpose can be conveniently made by splitting a white pine block into splinters about an eighth or three-sixteenths of an inch square and dipped into melted sulphur for about 4 in. so that they are thoroughly covered with sulphur. After cooling they are ready for use.

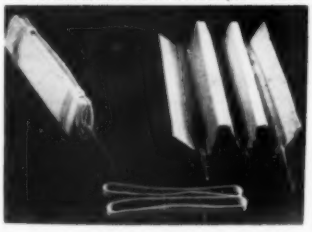
Carrying Files Safely

By F. E. RILEY

THE AVERAGE maintenance mechanic carries around an assortment of tools in his box and this includes files of various types which are generally thrown into the box, with no regard for their brittle teeth and their tendency to rust. Rough handling of files affects their useful life considerably and they will stay in good condition longer if they are given some sort of protection.

The illustration shows a simple and effective file wallet which can be made in a few minutes from a piece of cardboard and a couple of strong rubber bands.

How to fold the cardboard for the simple file wallet

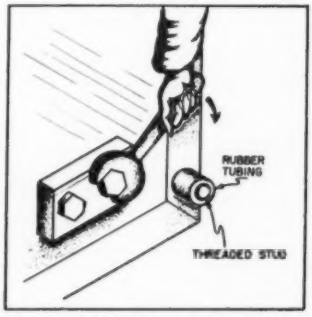


Spaces for the files are made by scoring halfway through the cardboard on alternate sides so as to form rough corrugations. The right hand view of the open wallet shows the bends which are made. On the wallet illustrated, it is not necessary to remove the rubber bands when a file is to be extracted; they can be pushed into or out of the spaces fairly easily.

Knuckle Buster Protection

By THOMAS TRAIL

WHEN USING a wrench to tighten parts on equipment having exposed threaded studs, a short length of

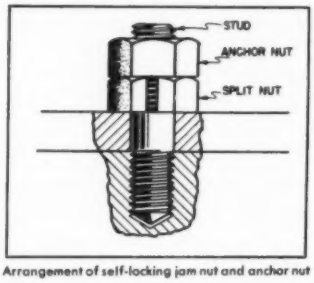


Short pieces of rubber hose over exposed studs

suitable diameter rubber hose or tubing temporarily slipped over each stud, as shown, will serve to protect the knuckles in the event of slippage of the wrench.

Stud Removing Simplified

A SELF-LOCKING jam nut can be easily made to remove studs without damaging the threads.



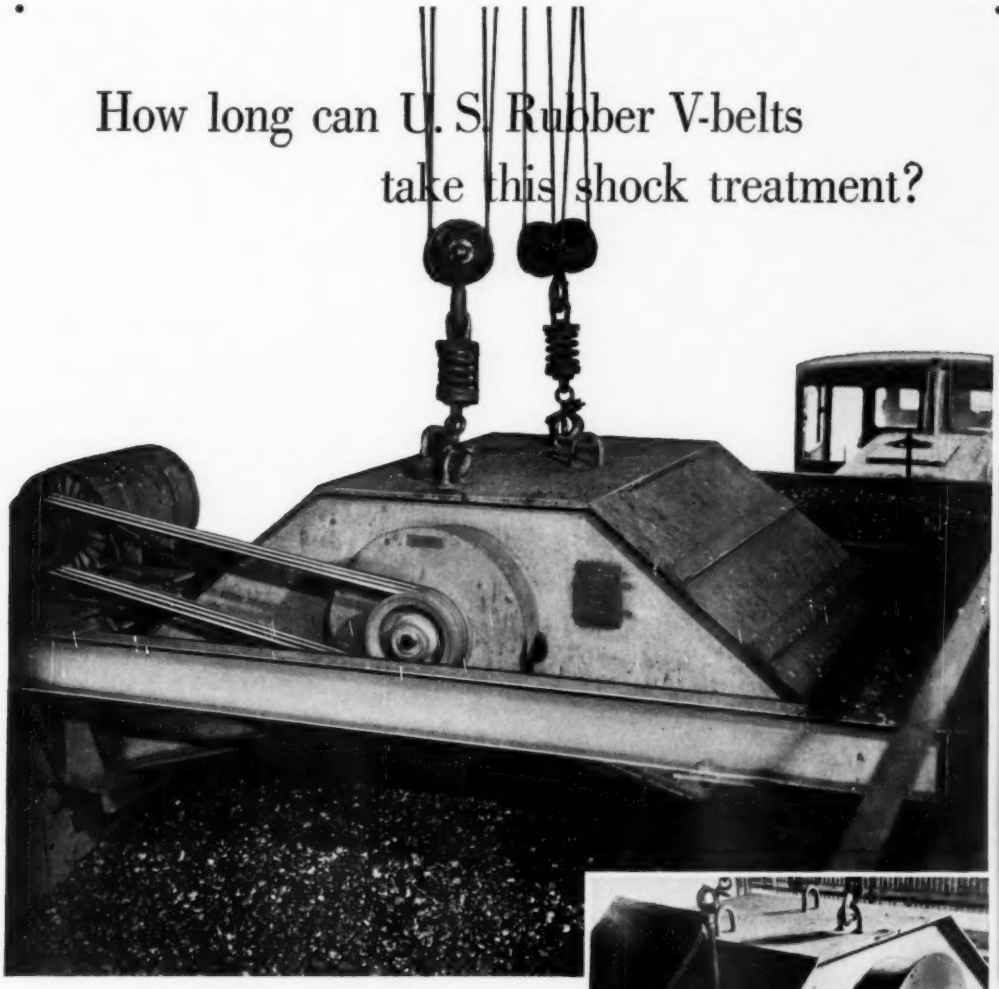
Arrangement of self-locking jam nut and anchor nut

Two standard nuts — one slotted lengthwise — are backed against each other. The pressure of a wrench on the split nut binds it to the stud threads, providing extra friction by which the stud may be removed. The second nut is used as an anchor.

Safe Grinding Wheels

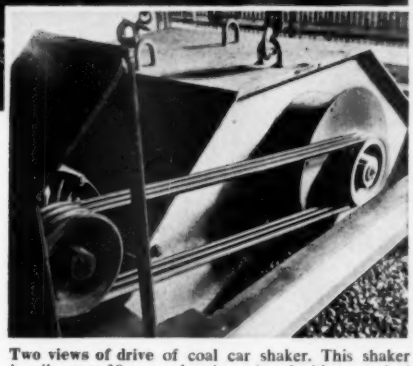
GRINDING WHEELS should run true and without vibrations; never run faster than the speed for which made; should always be fitted with protecting hoods; and have the drive belt

How long can U. S. Rubber V-belts take this shock treatment?



Working on a coal car shaker is probably one of the worst shock loads V-belts are called upon to take. With every revolution they must transmit the power to shake a loaded coal car with sufficient force to loosen tons of packed or frozen coal. Yet this matched set of "U.S." Rainbow V-belts has been working steadily on this shaker for more than 10 months. Previously, three other brands of belts had lasted an average of three weeks apiece. Moreover, the "U.S." belts never jump the pulleys as did the other brands that were tried.

Installing "U.S." V-belts always results in extra operating profit because "U.S." belts are built to handle *extra-rugged* conditions. They have the unique Equa-Tensil Cord Section – a development which makes certain that each cord pulls its *full* share of the load. For more information, write to address below.



Two views of drive of coal car shaker. This shaker handles over 30 cars a day, is equipped with a matched set of three C-144 super-service V-belts.

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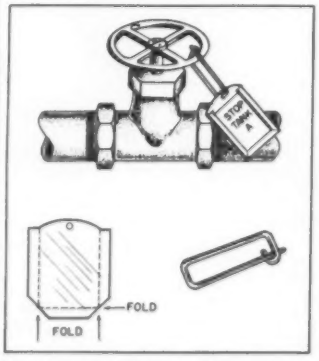
adequately guarded. Before installing a new wheel, it should be given a test to see if it is sound. This test is made by suspending the wheel free in air and tapping it with a wooden screwdriver handle. If the wheel is sound it will give forth a clear, metallic ring when so tapped. Bearings should be kept oiled, as a heated arbor may cause the wheel to burst. The tool rest should be set a little above the center of, and always close to, the wheel — and, when operating emery wheels, do not forget eye protectors.

If you have any aluminum that has to be ground, do it on a grinder of its own. Do not grind it on the same wheel that you do iron. Iron plus aluminum equals thermit. Thermit equals heat. A hot wheel can burst.

Valve Tags

TAGGING INFREQUENTLY used valves of any pipe line is a simple task. When plants are first constructed some permanent sort of identification mark should be placed at least on the most important valves and controls. The sketch shows a simple way to make up tags and attaching pins. The tags have provision for insert cards and celluloid covers.

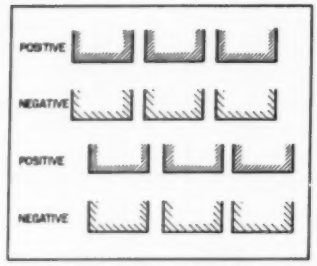


How to make tags and pins and where to use them

Permanent tags of heavy stamped metal should be attached by means of screws to the casting or soldered whichever proves to be the most practical.

Staggered Brushes

BRUSHES ON COMMUTATORS must be carefully adjusted and the brush holder spacing should be uniform around the circumference within plus or minus 1/32. This can be checked conveniently by a tape around the commutator. Brushholder arms should be staggered in pairs in an axial direction approximately 3/8 in. to prevent grooving of the commutator. Brushholders on d-c machines should be adjusted so that the pressure on all brushes is as uniform as possible



Staggered brushes prevent a grooved commutator

to prevent selective action by which certain brushes may take more or less than their proper share of the load. Brushes should be checked frequently to make sure that they move freely in the holders. Any found sticking can be freed by sanding the high spots with fine sandpaper.

Pipe Inspection

AFTER NEW STEAM PIPING is in place on a job and before the insulation is applied, it should be tested for leaks. Common practice is to apply hydrostatic pressures two and one-half times as great as the steam working pressure. If a job stays tight at this pressure for 4 or 5 hr., it is deemed satisfactory and should remain tight under the normal steam pressure. Careful inspection should be made to detect poor materials, but if shop inspection has been rigid, none of the parts should have to be replaced after erection.

Some designers and erectors purposely plan to give all steam piping an original strain by pulling up bends and long offsets, knowing that after the steam has been turned on, these strains disappear as the pipes expand. It is also true that, even if strains are set up due to expansion in such lines, after some time has elapsed, the systems adjust themselves and all stresses are equalized. This is particularly true when the designs are such that no solid anchorages are installed.

Packing Lubricant

TO KEEP GLAND PACKING SOFT, the use of cylinder oil in which a quantity of colloidal graphite is suspended can be used effectively. Graphite particles penetrate the packings, keeping them soft, allowing more perfect joints and reducing rod scoring. The colloidal graphite has extremely fine particle size which permits complete penetration.

"You got your Third Class papers, eh, Toby? — Good! That's what we call a learner's permit."

Simplification

is the KEY

TO LOWER COAL HANDLING COSTS

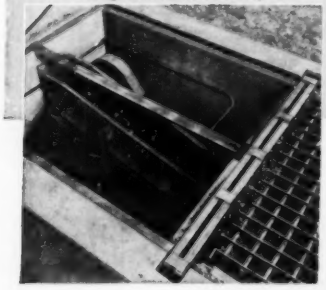
See How G-W does it with Four basic designs!

This installation at Universal Match Corporation, Hudson, N.Y., is one of **four basic types* . . . evolved by G-W to simplify design, manufacture and erection of dependable coal storage and handling equipment. G-W engineers recommend its cylindrical steel tank type of storage because it required the least amount of space and attention . . . is clean and economical to install and maintain.

Auxiliary equipment consists of feeder and conveyor from truck and track hoppers and bucket elevator to 90 ton tank at 25 tons per hour. Coal is discharged direct from storage to stoker hopper.

4 BASIC WAYS TO CUT COAL HANDLING COSTS

Showing bar feeder in hopper delivering coal to screw conveyor.



*The other three G-W basic types of coal storage systems are: reinforced concrete silo, vitrified tile silo, suspended steel bunker . . . the result of over 135 years of experience in installing hundreds of coal handling systems. Why not consult a G-W engineer? He will be glad to show you how one of these four basic designs can simplify your coal handling problems . . . reduce your costs.

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Bulletin No. 300 describes 14 case histories utilizing these 4 G-W basic types. Write for your copy today.

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Questions and Answers

Your fellow engineers will answer your power plant questions. You answer theirs, get paid well. Simple? Effective? Just try it!

Question No. 479

What Can He Do About This Hotwell Pump?

IN OUR industrial power plant we generate steam with two 30,000 lb per hr boilers and supply it to a number of industrial processes. From these large quantities of usable condensate are returned to a large concrete hotwell in the boiler house. From this hotwell a centrifugal pump delivers it to the deaerating heater in the usual manner.

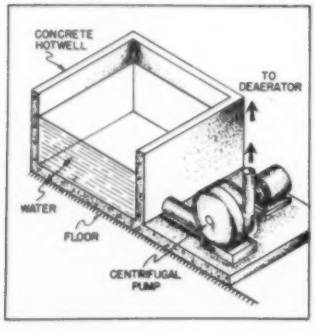
Our problem is well illustrated in the accompanying sketch. The plant is fairly new, and the concrete hotwell was built down in the basement right on the foundations. Then the centrifugal pump was installed on the basement floor, taking suction near the bottom of the hotwell as shown.

Now the condensate returns come back into this hotwell at temperatures between 190 and 200 F. When the hotwell level goes down, the centrifugal pump begins to cavitate and steam bind, and will not pump water out of the hotwell to the deaerating heater.

The contractors who installed this equipment maintain that our condensate returns are coming back entirely too hot — that 200 F condensate is entirely too high. We maintain on the other hand that there are a great many plants in which condensate at 200 F is being handled successfully.

However, for both structural and cost reasons, it is not possible to raise the hotwell because that would require expensive changes in the piping leading to it. For good reasons it is not possible to dig a pit and lower the pump below the hotwell. It is clear that the pump does not have sufficient net positive suction head, especially for the hot water it has to handle.

Diagram showing how M.P.'s hotwell and hotwell pump are installed, resulting in pump trouble when handling 200 F condensate from processes



But what can we do at a reasonable cost to pump that water properly? It is valuable boiler feed, being free of oil and contamination, and we want to get all that heat back into the feedwater heater as quickly as possible.

East Chicago, Ind. M. P.

Answer No. 494

What's The Right Way To Take Fuel Oil Samples?

IN THE APRIL ISSUE Ambitious Al expressed a desire to acquire first-hand knowledge, including any tricks of the trade, needed to sample fuel oil accurately and correctly. Specifically, he wanted to know what equipment to use, how to use it, where to take samples and what containers to put them in and, finally, what special piping and valve arrangements are needed. Here is some help for Ambitious Al.

See also When, Where and How to Sample Fuel Oil, by J. P. Stanton, July issue.

Tips From Fitzpatrick

OIL SAMPLING and testing is intended to represent by means of a small portion the entire contents of a car or tanker. It is evident, then, that a sample selected at random cannot be representative. Complete and detailed methods for oil sampling are described in ASTM Standard D-270-33.

Many engineers prefer a composite sample of their entire oil storage, and take samples from a simple pipe tap between oil pumps and burners. If newly unloaded oil is continually intermixed in storage, this method generally gives a representative sample of fuel being fired in the plant.

In testing new cars a very efficient approach is to install 3 or 4 cocks or valves in the incoming unloading line. After approximately 300 gal have been unloaded, these cocks are cracked slightly and set at a flow to obtain about a 25-gal sample by the time unloading has been completed. This large sample is then mixed thoroughly with a metal paddle, and a much smaller sample extracted.

Another method is to use a glass-stoppered bottle with a string attached to the stopper and another to the bottle and lead weight. The bottle is lowered to the desired depth in the tank and the stopper removed with one string. When the container is filled it is brought to the surface with the other string. Usually 8 or 10 samples are taken in this manner, then intermixed, until finally a representative sample is secured.

In every case the oil sample should be a true sample and should always be selected with the same precautions as taking coal samples or boiler water samples.

Laboratories generally furnish oil sample containers. A 1-pt metal screw top can is the most commonly used unit at present. This is easily packed for express shipment and a few turns of plastic electrical tape wrapped around the cap guards against leakage. Plastic tape is oil-proof and not affected by No. 6 oil. It is usually inconvenient to write on the label affixed to the can, so a heavy cardboard tag securely wired to the sample is more suitable. The tank-car number, if any, date, and the producer's trade name, if more than one brand is used in the plant, should all appear on this tag. Complete information then will appear on the laboratory report and will avoid confusion when a number of these reports are studied at one time.

L. W. FITZPATRICK

Jefferson City, Mo.

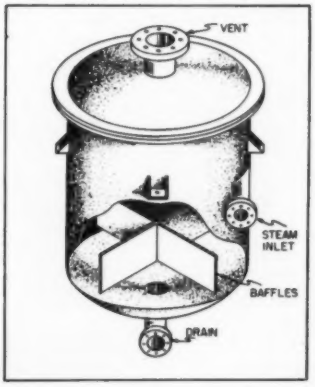
Answer No. 495

How Can He Stop Dirty Spray From Blow-off Tank Vent?

TO HELP H.T.L. solve this problem (April issue) here is a drawing of a tank designed in 1931. This tank was used for a blowdown from two 380-bhp Bigelow-Hornby water tube boilers and feedwater lines, until a few years ago when the plant was torn down. The tank was still in good shape.

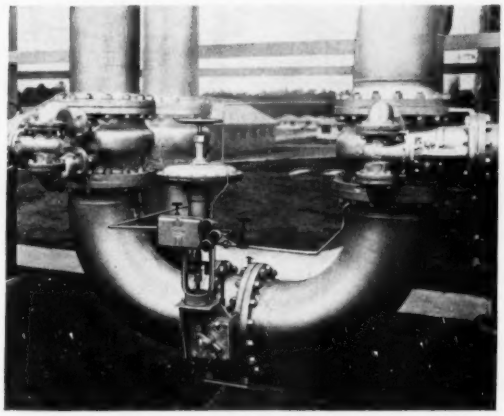
The vent line, rising to just above the roof, was about 50 ft long with two 45-deg offsets to avoid equipment above. The drain was in the center of the bottom, with cross baffles as shown to stop the whirlpool action of water around the outlet. As shown, the blowoff connection tangent to the cylindrical shell had no obstruction inside the tank to cause turbulence. No water remained in the tank between blowoffs and the drain was to a river about 200 ft away.

Design of blow-off tank, submitted by Rowley, which was used for many years and never discharged dirty spray on any adjoining buildings



R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



▲ **R-S Automatic Valve installed on water jacket to gas engine in gas booster station.**

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R-S Valves are used in air, gas, liquid, steam, and semi-solid service for the shut-off and regulation of volume and pressure, pressure relief, liquid level control, back pressure, water hammer, steam hammer, constant differential pressure, and the output control of pumps, fans, engines and turbines. Suitable for service in the temperature range from minus 300° to plus 2000° F. 2 to 2500 psig.

Simplicity of design, ease of operation, positive rubber seat shut-off, and the wide range of application indicate the high order of metallurgical and mechanical engineering that is embodied in every R-S valve.

Consult your local R-S Valve Engineers, or write direct.

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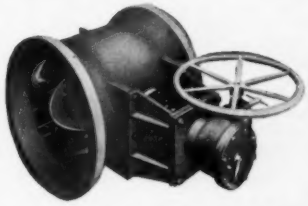
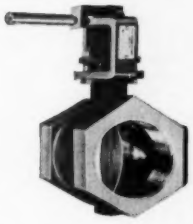
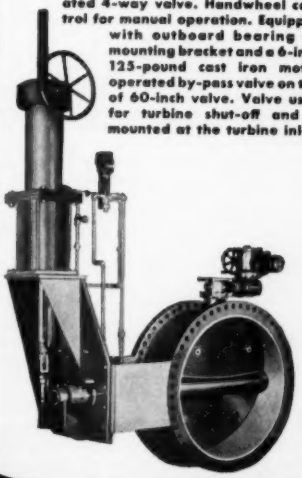


No. 836—24-inch 125-pound cast iron hub-end valve with bronze liner and monel periphery on vane for water service. Equipped with totally enclosed gear reducer, handwheel and locking device.



No. 801—3-inch 125-pound bronze screwed-end valve with handlever control and locking device.

No. 828—60-inch 150-pound cast steel valve with 18-8 shafts, bronze bushings and bronze body liner. Cylinder operator is controlled by electric motor operated 4-way valve. Handwheel control for manual operation. Equipped with outboard bearing on mounting bracket and a 6-inch 125-pound cast iron motor operated by-pass valve on top of 60-inch valve. Valve used for turbine shut-off and is mounted at the turbine inlet.



The top of the vent was an open-end pipe looking straight up and it never caused any damage or marks on adjoining buildings or cars parked below, near the boiler house.

Other features of the above design, which you may or may not want to follow, are: bolted-on cover for inspection or repair; floor supports above inlet; and drain to allow for pipe connections in trenches below the floor.

Recently this design has been used for a steam blowoff for 1200-psig boilers at one of our generating plants.

Berlin, Conn. L. T. ROWLEY

Answer No. 496

How Should He Hook Up Synchronizing Transformer?

THIS QUESTION in the May issue brings up a most important requirement for synchronizing machines; that is, the need for the indication of the device to show exact phase agreement.

Paralleling units with star (grounded wye) and delta ungrounded windings of different systems presents no problem when approached correctly. But, as indicated in the question, the synchronizing transformer for the grounded system, which we will call A, is connected from line to neutral but the ungrounded system, which we will call B has no neutral availalbe and it might be assumed to be a reason for the question.

There are three possible ways of taking care of this condition but if the connection as shown for system A transformer must continue, a neutral must be made available for system B or special provision must be shown for the synchronizing device as described hereafter.

The diagrams, Figs. 1, 2, 3 and 4, show what happens with system B synchronizing transformer connected to Line 1-2. Figure 4 is a superposed view of the two systems. Reference to Fig. 4 shows how, at synchronism, the voltage 4-6 differs from 5-7 by 30 deg, which in actual value will be 57 between terminals 6 and 7.

If synchronizing is done with lamps and for the "dark" position, the resultis uncertain; if the conventional revolving type of synchroscope is used, the position of the pointer will not be at the top as generally used, but will assume a position having a 30-deg angle in either direction, as determined by test. Such a set-up has been used, but is not considered a a desirable one for obvious reasons.

Two methods remain for use, depending upon the desire of the user. The simplest would be to replace the system A transformer with a 12-kv unit connecting it to Lines 1 and 2 as for B, shown in Fig. 5. Should this not be practicable, a neutral could be established for system B by using three transformers, as shown in Fig. 6. The superposed systems vector diagram for Fig. 6 arrangement is essentially as in Fig. 7.

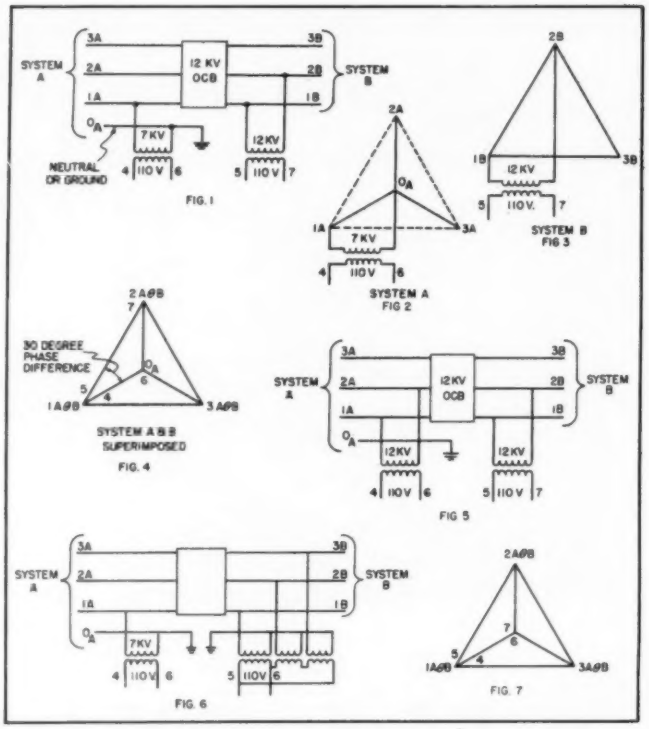


Fig. 1. How synchronizing transformers are now connected, showing the connection to Lines 1-2
Fig. 2. Vector diagram of System A synchronizing transformer with the connection to Lines 1-2
Fig. 3. Vector diagram of System B synchronizing transformer with the connection to Lines 1-2
Fig. 4. Vector diagram showing Systems A and B superimposed with the connection to Lines 1-2
Fig. 5. One solution might be to replace the System A 7-kv transformer with a 12-kv unit
Fig. 6. Another solution is to establish a neutral for System B by using three transformers as shown
Fig. 7. The vector diagram for the hook-up of Fig. 6 showing the effect of using three transformers

Concerning trouble with the transformer on the delta system B in the event of a ground on the delta system, there is no apparent reason why faults should occur in the synchronizing transformer. For Figs. 2 and 5 with 12-kv OCB closed, the voltage stress normally to ground is less than 7 kv, since the A side is grounded and a ground on the delta system would affect the main transformers of both the A and B systems with a current flow to ground depending on its impedance.

With the 12-kv OCB open, system B has the characteristics of any ungrounded delta with a floating neutral voltage to ground which may vary from 7 kv (69.3) to full voltage depending on the conditions of the system insulation. With a ground, the stress on the winding may be raised to full voltage which is not a serious condition for this voltage range. The synchronizing transformers can be protected by conventional type fuses or current limiting reactors or a combination of the two on the 12-kv side.

C. O. VON DANNENBERG

Brooklyn, N. Y.

Answer No. 498

Will His Pump Lose Suction After Shutdown?

READER W.M.L., in the June issue, said he was planning to replace a reciprocating duplex pump with a centrifugal 1500-gpm fire pump for his plant's hydrant supply. A 530-ft suction line runs from the pump to the bay, dropping 10 ft. His question is: Would all of the salt water be lost from the suction piping after each shutdown? A salesman for a company manufacturing centrifugal pumps says yes!

Not Necessarily, Says Carter

THE QUESTION does not state if the pump is to be equipped with a discharge check or gate valve, or both. It would seem likely that either or both are to be provided, or that all hydrants or other outlets will be closed, otherwise the pump could never be primed.

As a child did you ever put a milk bottle under water in a pond so it was filled with water, then turn it

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bottom up and start lifting it out of the water? Do you remember that none of the water ran out as long as the neck of the bottle was kept ever so slightly below the water level in the pond? To get any water to run out of a bottle (assuming sea level and 62 F water) the bottle would have to be about 34 ft long since the maximum column of 62 F water that can be supported at atmospheric pressure at sea level (30 in. of mercury) is 30 times 1.134 minus 0.5597 times 1.134, or 33.385 ft. Thus in an inverted bottle or tube over 34 ft above the pond water level there will be a 33.385-ft column of water and the space above will be filled with water vapor at an absolute pressure of .5597 in. of mercury, the vapor pressure of 62 F water.

In this installation, the suction line inlet is sealed by 3 ft of water. Thus, the only way it is possible for water to leak out of the pump and piping is (1) for there to be gases dissolved in the water which separate off when the water is held under a vacuum of 8 ft of water maximum or (2) for there to be leakage of air into the suction piping through the joints or into the pump through the stuffing boxes.

Most natural waters have some dissolved gases which are released under reduced pressures but usually the amount released is too small to be of much consequence. Leakage of air through joints in the piping and through the stuffing box of an idle centrifugal pump is a common occurance. With a tight suction line and a well packed stuffing box properly adjusted, leakage of air into the pump will be slow. Some air leakage must be expected through a stuffing box of a centrifugal pump when shut down and under a vacuum, otherwise the packing would be too tight for normal operation.

If, in an installation as described by W.M.L., it is desired to keep the pump and suction piping continuously primed, an automatic priming system of one of the types discussed in my article in the March, April and May, 1946 issues of *Power Plant Engineering* entitled How To Prime Centrifugal Pumps, should be used.

One paragraph of that article stated: In some cases, a pump which has been operating on a lift and which does not have a foot valve, will hold its prime when shut down for a considerable period because the suction line is tight and the stuffing box is in good condition and properly adjusted. Such units can be restarted as they are fully primed. The time in which a pump loses its prime is a measure of the tightness of the suction line and the condition of the stuffing box. If a pump loses its prime quickly, the suction line should be checked for leaks and the stuffing boxes should be inspected.

Harrison, N. J. ROY CARTER

Leader Says It Will

THE SALESMAN is right. All water in the line will drain back to the level of the bay when the new pump is shut down — unless there is a foot valve to hold it.

With the old reciprocating pump the situation was somewhat different, since pump valves served to seal the upper end of the suction line. In a centrifugal pump there are no valves, or anything, to prevent back flow when the pump stops.

A check valve installed at some point on the suction line near the new pump might, if perfectly tight, hold water in the line up to that point; and serve the same purpose as valves in the reciprocating pump. This would greatly reduce time and water required to prime pump and line.

It is necessary, of course, to completely fill the pump casing and vent the air before the pump will deliver. A reciprocating pump can pull a slight vacuum by itself — a centrifugal pump cannot.

Density of the salt water has no bearing on the case as far as keeping water in the suction line is concerned.

Apponaug, R. I. A. M. LEADER

No, If Leak-Proof; Yes, In Practice, Says Lacey

IF THE ENTIRE SYSTEM was leak-proof, no water would run out when the pump is shut down. During shut-downs the system would be under suction, equal to the difference in height between bay water level and the point in question. Only way water may leave the system is to have an equivalent volume of air displace it. Since the system is under vacuum, any leaks will allow air to enter and displace water. In practice it is almost impossible to have a leak-free system. For this reason, I believe the system should be designed as if it will drain completely after each shut down, unless other provisions are added.

The sketch (accompanying the question) showed the pump above suction level with no provision for priming. Unless the pump is primed, I seriously doubt if it can be started pumping the first time it is run. If the suction line drains, the same would hold true.

Editor's Note: In his original question, W.M.L. mentioned a priming device would be needed. Its capacity, he said, would depend upon whether the suction pipe emptied itself or not. So he was not forgetting it.

A small positive displacement pump could be used to suck air out of the suction line and raise water to the pump casing. This pump would be run only when it was desired to use the main pump. Depending upon its capacity, the small pump would probably take several minutes to effect a prime.

Another method would be to hook a small steam (or water) eductor to the main suction line at the pump, or on the casing, and allow it to run continuously. Capacity of the eductor would be much less than the small pump, but it would only have to handle air leakage. With this method the main pump would be ready for instantaneous service.

The pump stuffing box may cause trouble. A properly packed pump should leak enough to cool shaft and packing. Leakage will tend to increase with age, especially with intermittent service. Presence of salt will make this increase more rapid, because of crystallization between shaft and packing resulting in abrasive wear whenever the pump is run. This, of course, will increase air leakage when the pump is shut down. This condition can be helped if the pump is equipped with lantern rings, and clean, fresh water is run to them.

Niagara Falls, N. Y. J. A. LACEY

Yes, Says Galloway

Without a foot valve, check or similar device all the water in W.M.L.'s line will drain back to the bay in a rush. If there is considerable discharge piping with no check, his pump will spin in reverse with possible damage. Disregarding any calculations, the old axiom "water seeks its own level" answers the question. However, W.M.L.'s most important problem is how to operate the new pump properly in the future. Fire protection service is vital and nothing should be left to chance.

Foot valves are often used, but they are difficult to inspect or repair. They also tend to leak during long shut-down periods, or even to fail entirely at a critical time. I would advise against using one in this installation. Since the pipe is underground a pit should be made on the horizontal run as close as possible to the existing elbow at the top of the riser from the bay. At this point a swing check valve should be installed or, if convenient, an angle check valve substituted for the elbow.

At some convenient point near the pump make a pipe connection, of at least 1½ in., to the discharge line using a swing check valve and a gate valve for control. This small line should be connected to a positive supply of water under pressure. Use of the supply line is obvious since it will serve to fill the entire suction line and pump.

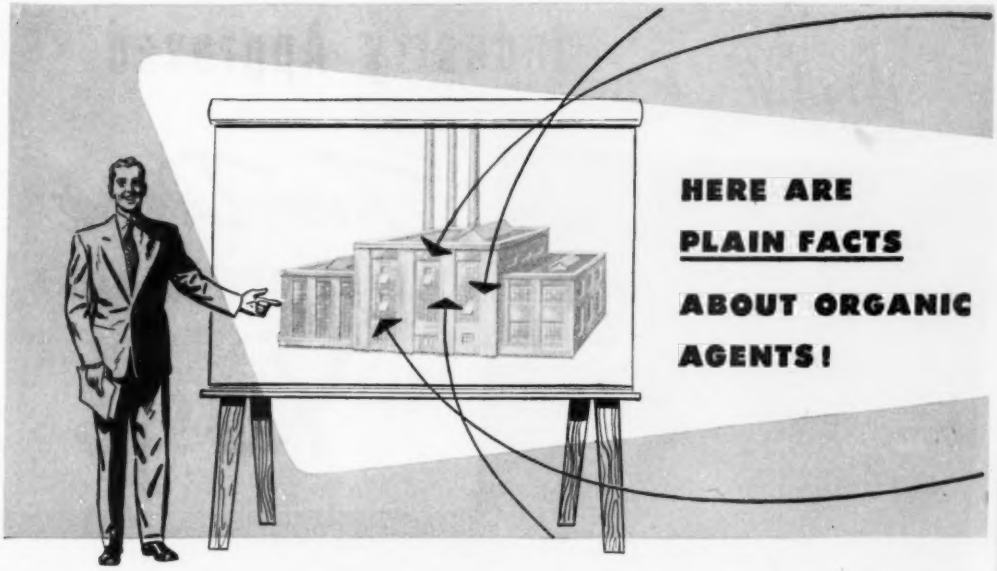
A pressure gage should be installed on the pump. When filling the system bring the level about 10 ft higher than the pump and note the pressure on the gage. It should never be allowed to go lower.

If everything holds tight one filling should be sufficient, but the best of check valves may leak and the suction pipe itself may corrode or settle and crack. Installation of an alarm gage which will sound a warning if pressure drops below a predetermined point is a further safety measure.

I believe all these precautions are necessary on a fire pump and, if followed, W.M.L. can be confident that when the need for the pump arises it will be ready to serve instantly.

R. V. GALLOWAY

Staten Island, N. Y.



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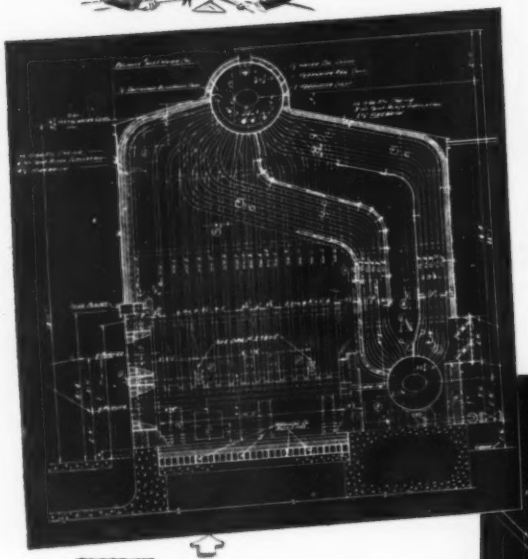
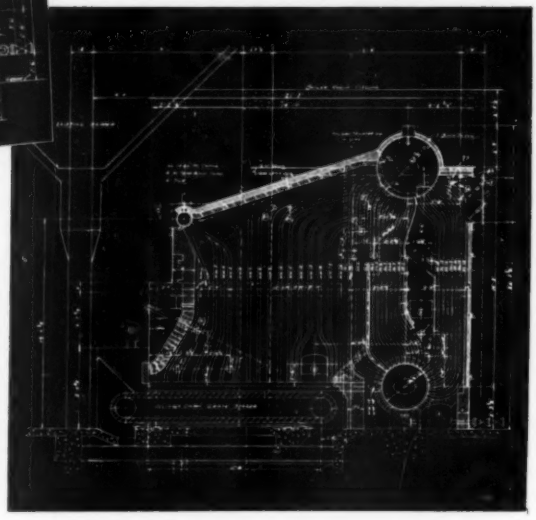


CLASS VF
A 22,000 pounds steam per hour unit installed at Indiana Farm Bureau Refinery, Mt. Vernon, Ind.



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Class VF units provide maximum capacity in limited floor space and head room, while Class VS is best adapted to installations not having such restrictions. Each has a large furnace volume and a high ratio of radiant heating surface. The furnace design assures proper combustion of fuels fired in suspension or with various type of stokers.

A bulletin with general information and showing typical installations is available on request.

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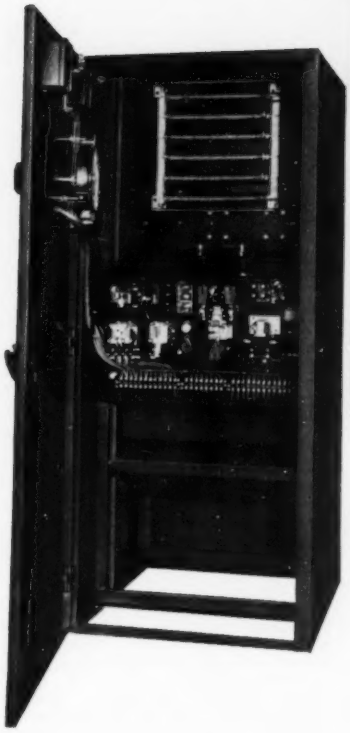

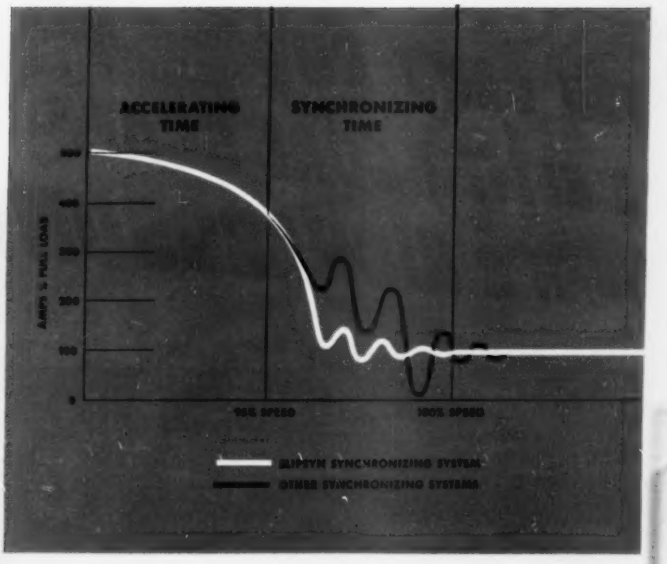

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Yes, through every phase of synchronous motor operation, Slipsyn starters do a precise, dependable, protective job. For full information, call your local Westinghouse representative or write, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-27031

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8353

Tips to Raise PF

(*Continued from page 79*)

Caution: — When the terminal which is common to the unit cannot be grounded, the capacitor case must be insulated from ground and labeled as energized equipment. In view of the above, it is generally accepted that two-bushing units prove safer and most universally useful in the long run.

Wound-Rotor Motor Losses

No plant survey would be quite complete without giving a little detailed attention to the universally-used, but also thoroughly-cussed, wound-rotor motor. For power factor ruination, there is hardly a more worthy competitor. That is particularly true where the motors are operating underloaded.

Let's consider motor efficiency. In this motor, current flows through the stator, across the air gap by transformer action, and into the external resistance. Friction, windage, copper and heat losses all take a little toll of the impressed current and we figure the efficiency as the ratio of the output to the input of a given part. For example, the stator output is simply the line input to the stator minus the stator losses and the efficiency is stator output divided by stator input. The stator power output appears at the air gap of the motor and is the power input to the rotor. Rotor efficiency is, therefore, shaft output divided by rotor input. If that reads like doubletalk let's use an equation where the over-all motor efficiency for any speed and load is:
Motor efficiency = stator efficiency × rotor efficiency.
Rotor efficiency = motor shaft speed, actual ÷ motor synchronous speed.

Turbine Maintenance

(*Continued from page 77*)

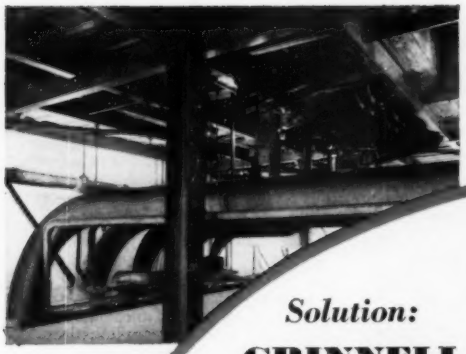
in pH value is sufficient to wash away oxidation products and give the moisture free access to raw metal. The erosion then becomes a step-by-step process of deterioration.

For running down this type of trouble pH recorders in boiler feed pump suction lines are the best means, and such a recorder connected to automatically control a caustic feeder is decidedly the most effective method for eliminating this tendency.

Spot checks are not adequate because the irregularities are most likely to occur during night hours whenever machines are changed or at whatever times drastic load fluctuations occur.

Vacuum Troubles

After all reasonable efforts during operation to discover causes of subnormal vacuum it is often necessary to search the hard way for faults not accessible normally.



Main steam piping at Salem Harbor Station of New England Power, 1000° F and 1450 psi, supported by Grinnell Constant Support Hangers.

Problem:

PIPING THAT GROWS...

Solution:

GRINNELL ENGINEERED HANGERS

Eight . . . nine . . . ten inches of thermal deflection! That's not a bit uncommon in today's high temperature, high pressure systems. Very hard-to-come-by, though, is the skill necessary for dealing successfully with suspension problems resulting from *"piping that grows"* . . .

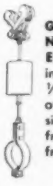
Large manufacturing facilities, expert technicians, and a lot of down-to-earth practical knowledge are needed.

Grinnell is America's No. 1 supplier of pipe hangers and supports, because Grinnell combines modern manufacturing with expert background knowledge gained during a century of piping specialization. Grinnell has developed hangers and supports for *every* piping need, from the simplest to the most complex. Grinnell, and Grinnell alone, can offer these advantages:

- Complete "start-to-finish" production facilities—including research, design, manufacturing, engineering and field service.
- Practical experience in every type of piping gained during the past 100 years.
- Coast to coast distribution—enabling "out of stock" purchases, anywhere.

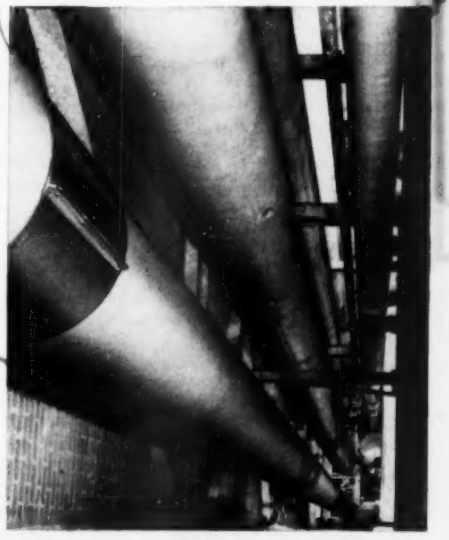
Grinnell is always ready to cooperate with engineers and architects in the preparation of pipe suspension specifications. Call Grinnell for pipe hangers and supports.

GRINNELL MODEL L CONSTANT SUPPORTS maintain full safety factor in high temperature, high pressure systems. 3 physical structures accommodate maximum travel requirement of 2½, 5 and 10 inches; 16 sizes collectively cover numerous load ranges between 141 and 19,530 lbs.



GRINNELL PRE-ENGINEERED SPRING HANGERS — maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes. 16 sizes available from stock — load range from 74 lbs. to 9000 lbs.

GRINNELL VIBRATION CONTROL AND SWAY BRACES — dampen vibration, oppose pipe sway and absorb shock. 3 sizes give full deflection forces from 200 to 1800 lbs.; have initial precompressed spring forces from 50 to 450 lbs. respectively.

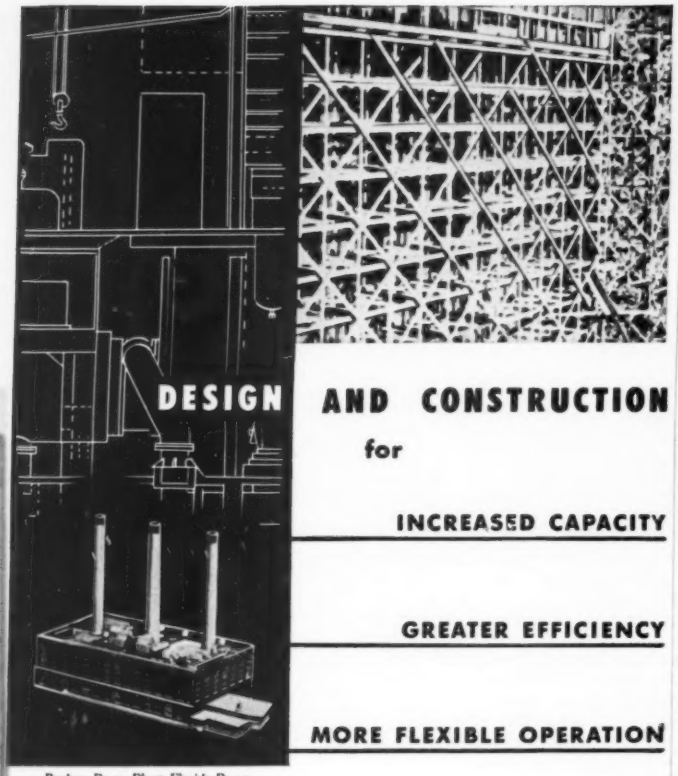


GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



Bayboro Power Plant, Florida Power Corporation, St. Petersburg, Fla.

Increasing population and great industrial growth demanded rapid expansion of Florida Power Corporation's Bayboro Plant. The solution of this urgent power problem is an excellent example of how creative engineering surmounts the obstacles met in modern expansion projects.

Making maximum use of existing facilities, The Kuljian Corporation's *design* provided needed additional capacity with increased over-all efficiency and greater control flexibility.

Construction was completed by The Kuljian Corporation on a seemingly impossible schedule to permit tie-in to existing equipment during a low-demand period.

The Kuljian Corporation's experience in solving many power generation and utilization problems can help you win your race against time . . . profitably.

The **Kuljian** *Corporation*

ENGINEERS • CONSTRUCTORS

1200 North Broad Street, Philadelphia 21, Pa.

MEXICO CITY • CARACAS • MADRID • ROME • ATHENS • TOKYO • CALCUTTA

Among blind spots that should be under suspicion are bolted flanges in hard to-get-at locations, usually due to foundation interference. Copper expansion joints often crack back of the retainers. On jet and other direct contact type condensers injection piping and pumps become possible sources of air leakage. Open surfaces and flanges may merit an extra coat of paint to stop infiltration.

Structural Weaknesses

In the course of time, natural wear and erosion weakens original structures and removes metal gradually. This naturally uncovers such things as foundry or forging flaws. Some of these will be obvious to the eye. Others may require special means for detection.

The whiting (whitewash) test for inherent flaws and for cracks in wheels and other large parts is simple to apply and fairly effective. Magnetic testing for similar defects is more effective and is used on wheel blading as well. This requires the services of a specialist and a direct-current power source such as a welding set.

Practice differs on the use of these tests, but we consider magnetic testing justified at least once in five years on all high speed rotors. Some insurance companies are more exacting.

Tendencies toward failure frequently appear in the form of stress lines on eroded surfaces, more commonly where relatively high stresses are involved. Sharp notches or irregularities should be smoothed up by grinding.

Bolts are often overstressed by driving down too hard. Examination of bolt threads and a comparison with another similar bolt in inverted position (rather than a thread gage) will suggest either discard or rethread.

Special instructions are given by equipment manufacturers for handling bolts on high-pressure, high-temperature units.

Maintenance Records

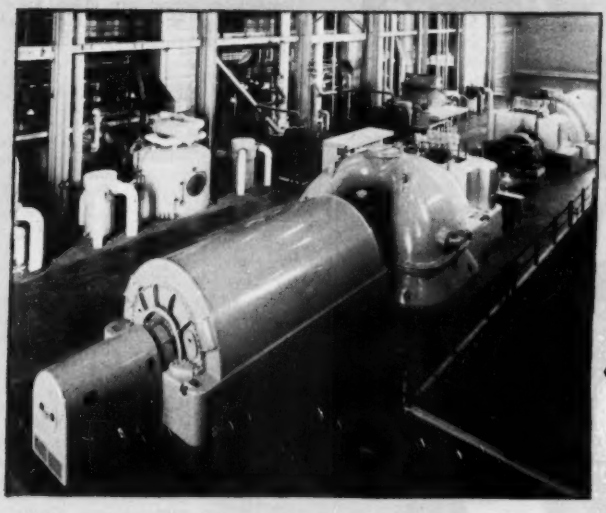
In addition to the suggested extensive word picture of physical conditions found during general inspections it is advisable to take close up photos of deteriorated parts "as found" and "as left." A well-taken photo of a small crack, for instance, may be made to tell a more accurate story than a naked eye inspection of the same area. The same reasoning applies in respect to eroded surfaces.

The results of laboratory work on oil and oil sludge, blading deposits etc. should be made a feature of the permanent record.

Routine Maintenance System

There should be an established system by which all actual or threatened physical faults are put on paper and channelled into an active maintenance file. Usually a fair share of

"Through performance alone... inhibited turbine oils have won preference among major utility operators"



... and here's why so many of them choose SHELL TURBO OIL

Shell Turbo Oil exceeds every accepted specification for premium turbine lubricants. These are the notable qualities:

1. HIGHEST ATTAINABLE RUST PROTECTION

An effective *combination* of rust inhibiting additives goes to work at the source of rust formation. Rust problems are reduced to the very lowest level.

2. COMPLETE OXIDATION STABILITY

The anti-oxidant in Shell Turbo Oil has so far defied improvement! It provides outstanding oxidation stability and thereby minimizes sludge formation.

3. ANTI-FOAMING

The anti-foam agent used is so effective that air entrainment can be tolerated for considerable periods—avoiding unscheduled shutdowns.

4. EXCELLENT EMULSION CHARACTERISTICS

Shell Turbo Oil's remarkable protection against rust and oxidation is attained with the minimum tendency to formation of water emulsions in service.

5. PROTECTION AGAINST WEAR

The inhibitive agents in Shell Turbo Oil *add* to the wear-reducing qualities of the specially refined oil itself, an extra margin of safety for the bearings during critical starting periods.

We'll be glad to give you the full story on Shell Turbo Oil, with specific recommendations for your own generating units.

SHELL OIL COMPANY

50 West 50th Street,
New York 20, New York,
or 100 Bush Street,
San Francisco 6, California.

SHELL

SHELL TURBO OIL

ROTOJET Junior TUBE CLEANERS

Powerful, Light-weight for SMALL TUBES

Rotojet Junior Tube Cleaners are powerful, yet light in weight. They are fed easily through the tubes with the operating hose, and can be shifted quickly from tube to tube. Simple design and precision construction assure long service, efficient use of power, and freedom from trouble. Clean tubes from .495" to 2.062" I.D.

Bulletin J-410 shows Rotojet Junior motors and accessories to help you do a faster, more thorough tube cleaning job. Send for your copy.

S32 ROTOJET Junior Air-driven Motor, cone cutter, universal joint.

C439 ROTOJET Junior Air-driven Motor, universal joint, drill head

C324 ROTOJET Junior Water-driven Motor, univ. joint, pivot head.

C434 ROTOJET Junior Air-driven Motor, flexible coupling, expanding brush.

ELLIOTT COMPANY-ROTO DIVISION

147 Sussex Avenue, Newark 1, N. J.

such items can be cleaned up during short shut-downs on scattered dates. Those that must wait for the general inspection period are given appropriate weight in the decision on when to start the general inspection.

Engineer's License

(*Continued from page 73*)

tion fee. Within a relatively short time, the applicant will be notified of the results of his application.

By Indorsement: — It is possible, in certain states and under certain conditions, for an applicant to receive a license without examination. This is solely within the discretionary power of the board of examiners and education department. This waiver of examination and educational requirements, except for age, character and citizenship, is carefully weighed. Before the board will approve an applicant for a license under this provision, it always endeavors to make certain that he is fully qualified. Many boards recognize that years of outstanding achievement are far better evidence of qualifications than are the results of written examinations. Contributions to the profession such as activity in technical societies, presentation of technical papers, inventions, patents and developments are considered to be above and beyond routine duty.

Refresher Courses: — Applicants who are required to take the written examinations can prepare by signing up for refresher courses, home study or special tutoring when the case so requires. The various state societies for professional engineers should be able to recommend refresher groups for the applicant's consideration.

Engineer-in-Training: Young graduate engineers who cannot meet the experience requirements should check whether the laws of their states provide for the Engineering-in-Training classification. Many states have amended their registration laws to permit these engineers to take portions of the examination upon graduation to qualify for the certificate of EIT. Holders of these certificates, which are honored in most states on a reciprocal basis, must take the final portion of the examination when they have acquired the requisite experience to obtain a full professional license.

Engineering Education

(*Continued from page 80*)

can visualize the 100 ton rotor spinning at 1800 or even 3600 revolutions per minute, but it is so carefully balanced that, from the outside, one scarcely knows that it is running. In this respect, the Corliss engine, with its clicking valve gear, its reciprocating cross-head, its fly-ball governor, and last, but not least, the big pulley

The Megger®

Insulation Resistance Tester

...its own best salesman

Nearly every electrical man knows or has used the MEGGER Insulation Resistance Tester.

The Megger Tester has, over the years, become an integral part of electrical operations everywhere. Through its inherent qualities of ruggedness, accuracy, and dependability it has earned for itself the enviable distinction of being the most widely accepted device for measuring electrical resistance.

Right in stride with today's pace of production, the Megger Insulation and Resistance Tester is demonstrating, in severe industrial service, that it is the most practical and economical means for making insulation resistance tests within the ranges of the available Megger instruments.

MEET THE WHOLE FAMILY

On the next page we have illustrated and briefly described the instruments which now comprise the Megger Family of Insulation and Resistance Test Sets—all represent variations of and improvements on the original Megger Tester.

(over)

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Electrical & Scientific Instruments • 1316 Arch Street • Philadelphia 7, Pennsylvania

FRAHM RESONANT REED FREQUENCY METERS & TACHOMETERS

BIDDLE IMPULSE CABLE FAULT LOCATOR

JAGABI TACHOMETERS & SPEED INDICATORS

"TTR" TRANSFORMER TURNS RATIO TEST SET

JAGABI TACHOSCOPE

MEGGER LOW RESISTANCE OHMMETER

APIEZON OILS - GREASES - WAXES

MIDGET MEGGER CIRCUIT TESTING OHMMETER

The Famous Family of *Megger*® Insulation Testers

One of the outstanding characteristics of all types of Megger instruments is quality of a high order. The performance and endurance records which these instruments have achieved are difficult, if not impossible, to match in any type of portable testing device. For insulation resistance measurements Megger instruments are *the recognized standard*. Today more than ever they are "indispensable tools" for electrical preventive maintenance and other electrical resistance testing in the field, plant, or laboratory.

Such developments as the rectifier-operated and dual-operated (hand or rectifier) sets perform repetitive tests more conveniently, more effectively, than can be done by hand cranking. Conversely there is no substitute for the hand generator in the field and for emergencies where supply current is unavailable.

HEAVY-DUTY TYPE MEGGER INSULATION TESTERS

Standardized ratings up to 50,000 megohms and 2,500 volts d-c with d-c generator for either hand or motor operation. Special ranges up to 100,000 megohms and 5,000 volts d-c.

Bulletin 21-20-IN.

MEG TYPE OF MEGGER INSULATION TESTERS

These light weight, easy-to-use instruments are available with ranges up to 2000 megohms, 1,000 volts d-c. Optional accessory features include ohm scales 0 to 10,000 ohms and ratio and discharge switches. *Bulletin 21-45-IN.*

RECTIFIER-OPERATED and DUAL-OPERATED MODELS are available in the same ranges for repetitive production or inspection tests. Complete details in *Bulletin 21-46-IN.*

MIDGET MEGGER INSULATION TESTER

Weighs only 3 pounds and is completely self-contained. A handy tool kit instrument; ratings up to 50 megohms, 500 volts d-c.

CVM CONSTANT-VOLTAGE TYPE MEGGER TESTER

Standard ranges up to 50 megohms, 500 volts d-c, with built-in constant voltage generator; ohm scale and selector switch optional. Both instruments described in *Bulletin 21-85-IN.*

BRIDGE-MEG INSULATION *and* RESISTANCE TEST SET

A Wheatstone Bridge and the Meg Type of Insulation Tester combined in one instrument which performs practically every electrical resistance measurement from a fraction of an ohm up to 1000 megohms. The addition of the Varley Loop feature is optional. For versatility and convenience this instrument is unsurpassed.

Ask for *Bulletin 21-60-IN.*

James G. Biddle Co.

Electrical & Scientific Instruments

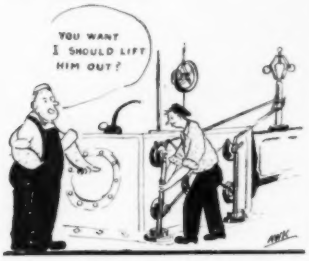
1316 Arch Street • Philadelphia 7, Pa.

or flywheel, was much superior; it was a sight worth seeing, and one could stand by the hour watching its rhythmic movement. The reciprocating marine engine was equally fascinating and furnished Kipling the inspiration for *M'Andrew's Hymn*.

There was less organization in the old days and engineers had to be more resourceful. If a machine broke down, they usually were good enough machinists to turn out a part on a lathe. Few jobs were too difficult to tackle.

Fun Mixed In

Often there were amusing incidents. My Californian correspondent relates an incident which happened in Whittier's (Saginaw) engine room as the kids dropped in on their way from school. "The mill had been shut down for the day and the engineer was cleaning the dashpots. He had one cleaned and oiled and put back, and was trying the vacuum by pulling on the rod. In came one of the burly salt packers accustomed to tossing around 300-lb salt barrels. Seeing the engineer apparently vainly trying to lift out whatever it was, he walked over and ventured: 'You no can lift him out?' And the engineer replied, 'No I can't!' 'You want, I should lift him out for you?' The engineer, seeing a chance for a little fun, said, 'Sure, go ahead!'



"The giant salt packer tugged on the rod mightily, but in vain, and finally asked, 'What is hanging on the rod?' The engineer told him, 'Just that piece of iron you see attached to it.' So the salt packer tugged some more and soon worked up a real sweat.

"After a few minutes the engineer went over and opened the pet cocks to let air under the dashpot and told the packer to try again. The giant, by this time somewhat excited by the challenge the job presented, braced himself and gave a mighty heave. Out came the rod so fast he could not hang on to it and the piston sailed nearly to the ceiling, over the engine and out of the power house, crashing through a window.

"The engineer, a little pale around the gills, rushed out expecting to find his piston in pieces, and, of course, the mill could not run until another one was cast and machined. It was intact, however, only needing cleaning, and it was soon back in place. By

You may be doing just that if your plans don't include CHLORINATION EQUIPMENT for slime control by WALLACE & TIERNAN.

Chlorination equipment because it controls slime that *grows* on the walls of condenser tubes not protected against it. Enough of the growth eventually seriously reduces heat transfer efficiency — actually *insulates* your steam from the cooling water. Back pressures go up, production drops, operating and maintenance costs rise, and eventual shut-down becomes necessary for regular clean-out periods.

Wallace & Tiernan equipment because it is versatile, sturdy and dependable — proven by thousands of successful installations, vouched for by satisfied users everywhere and because there's a Wallace & Tiernan chlorinator for every job. Write today for information on how Wallace & Tiernan chlorination may help you solve *your* slime problem.

NO WATER IS SLIME-FREE

regardless of the source. Chlorination helps reduce slime in make-up or cooling water.

CD-37

WALLACE & TIERNAN
COMPANY, INC.
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

When You Think of

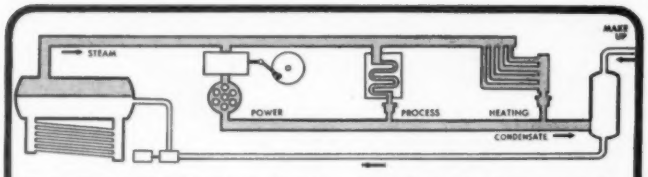
CORROSION PROTECTION for your STEAM SYSTEM

Think of

CORAVOL

(The Original* AMINE PROCESS) ®

Because CORAVOL Circulates to Control Corrosion



The CORAVOL ZONE—indicated by the shaded area in the diagram—includes every part of a steam system not accessible to boiler feed water treatment. It includes the boiler above the water line, steam lines, condensate return lines, radiators, valves, traps and equipment. This zone can now be reached and protected against rust and corrosive action—by CORAVOL.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special chemical formulas for . . . boiler feed water . . . foam prevention . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

CORAVOL circulating throughout your steam system protects it from corrosive attack. **CORAVOL** saves costly pipe repairs and replacements—maintenance labor—hours and days of shutdown loss. **CORAVOL** cleans out clogging rust deposits, improving heat transfer, restoring original capacity of lines and efficiency of valves and traps.

CORAVOL, the original* amine process, has the flexibility that lets it conform to each individual need. The **CORAVOL** you will use is formulated to do the best protective job under your own plant conditions.

*The use of **CORAVOL** in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

Chemical Water Treatment

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Complete Data about the CORAVOL Process

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repeating the performance with the pet cock open and closed, the engineer tried to explain the action to the salt packer, but it was too deep for him and he slowly walked back to his own domain shaking his head. We kids who had been watching all this, had known long before what the dashpot did and how it operated."

¿Quien Sabe?

Most everyone who grew up in such an environment understood how power was generated. True, the action of the dynamo remained a mystery to many but they knew its shape and purpose. Today, there are many men in business and the professions who do not know what a turbine is. Few of the millions of people who use electricity know anything about what lies behind the wall switch, nor do they care. They have never seen a turbine generator, and a power plant is more of a symbol to them than a reality. There is the story of the two ladies riding by a large utility with a hundred thousand tons of coal stored close by. "Look!" said one of the women to her companion, "how much coal it takes to heat that building!"

I don't profess to know whether this state of affairs is good or bad. In this complex world we can't know everything and this is the age of specialization. If a bond salesman does not know what a turbine is, neither does the power engineer know much about a debenture issue.

New Engineering Books Received

To be Reviewed in Detail Later

Fuels and Combustion, by Marion L. Smith and Karl W. Stinson; First Edition; 340 pages; illustrated; size 6¼ by 9¼ in.; cloth binding. Published by McGraw-Hill Book Company, Inc., 330 W. 42nd Street, New York 36, N. Y. Price $6.50.

★ ★ ★

Personnel Administration, by William W. Waite; First Edition; 683 pages; illustrated; size 6¼ by 9¼ inches; cloth binding. Published by The Ronald Press Co., 15 E. 26th Street, New York 10, N. Y. Price $7.00.

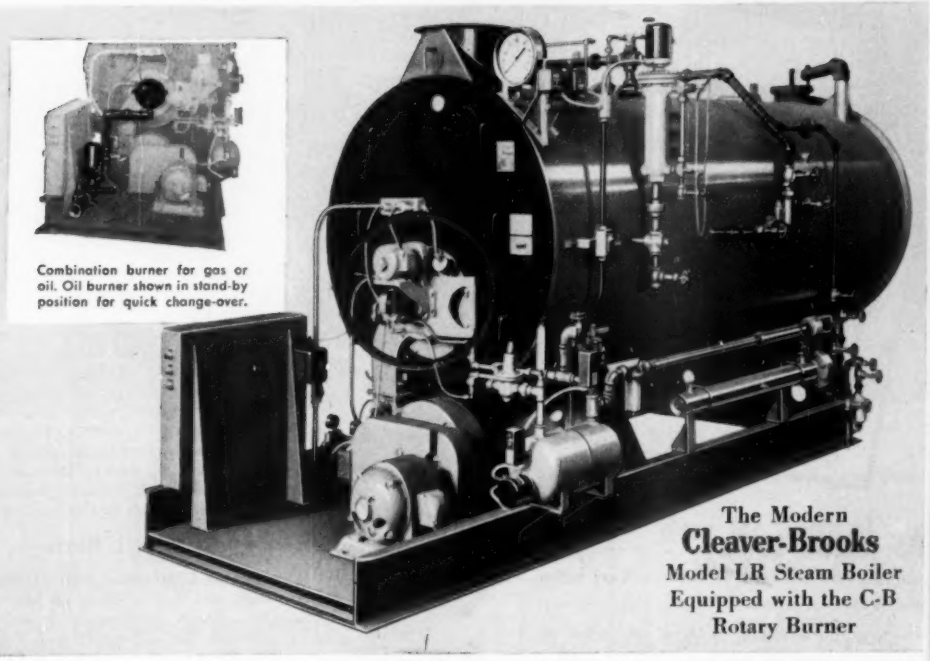
★ ★ ★

The Consulting Chemist and Chemical Engineer in a World Economy; 29 pages; illustrated; size 8½ by 11 in.; paper cover. Published by the Association of Consulting Chemists and Chemical Engineers, Inc., 50 East 41st Street, New York 17, N. Y. Price $1.00.

★ ★ ★

Energy Sources — The Wealth of the World, by Eugene Ayres and Charles A. Scarlott; First Edition; 344 pages; illustrated; size 6¼ by 9¼ in.; cloth binding. Published by the McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York 18, N. Y. Price $5.00.

unmatched Flexibility of operation ...and of quick fuel change-over



Combination burner for gas or oil. Oil burner shown in stand-by position for quick change-over.

The Modern
Cleaver-Brooks
Model LR Steam Boiler
Equipped with the C-B
Rotary Burner

✓ **Quick Steaming—Fast, effortless response to fluctuating steam demands**

✓ **Equally high efficiency using heavy No. 6 oils (or lighter oils) and all types of industrial gas**

IF the quantity of steam required in your plant fluctuates throughout the day, depending upon the amount of steam-using equipment in operation, you can cut your steam costs substantially with a Cleaver-Brooks Boiler. It operates at a full 80% guaranteed efficiency whether you require maximum load use of all steam-using equipment . . . or whether your equipment is not in use, requiring as little as 30% response — often just enough to heat the plant.

Install a Cleaver-Brooks Boiler — oil, gas, or combination — either fuel properly proportioned by the exclusive Cleaver-Brooks Burner to meet your fluctuating or constant steam demand. Fully automatic, clean, with a single source for all of its matched parts . . . you benefit with lower fuel bills, less maintenance, reduced operating costs, greater profits. Why not consider changing your present boiler plant and think of flexibility — remember Cleaver-Brooks and get the complete facts on boilers, 15 to 500 HP — 15 to 250 lbs. psi.

Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler catalog.

Cleaver-Brooks
STEAM BOILERS
the first and finest of their class

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Dept. J 310 E. Keefe Ave., Milwaukee 12, Wis., U. S. A.
Cable Address: Clebro-Milwaukeewis

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

ON THE JOB FOR 50 YEARS— REFUSES TO BE PENSIONED!

On January 24, 1902, this 2½" Foster Type W Pressure Reducing Regulator was bought by a Southern Cotton Mill, and was put to work reducing boiler pressure of 125 lbs. to 20 lbs. in one of the most modern steam systems of its time.

October 19, 1951, this veteran was sent to us for repairs. After having its picture taken and being overhauled it was returned to active service without ceremony.

As made today, with enclosed spring chambers, Type W Regulators are being widely used as pressure reducing valves for fuel oil, lube oil, gasoline, naphtha and other inflammable liquids. They *look* different, but will give long dependable service because the materials, heavy-duty construction, and workmanship are the same.

To You, the fact that a single Foster regulator has a fine record may not seem too significant. But it illustrates the fact that when you buy a Foster regulator, you actually get *engineered regulation*, which means the long, trouble-free performance only a well engineered, properly built product can provide. That's an important point to remember the next time you need regulation.

FOSTER ENGINEERING

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . CUSHION CHECK VALVES . . . ALTITUDE VALVES . . . FAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN VALVES . . . VACUUM REGULATORS OR BREAKERS . . . STRAINERS . . . SIRENS . . . SAFETY VALVES . . . FLOW TUBES

Thermal Fatigue and Thermal Shock, by Helmut Thielsch; 24 pages; illustrated; size 8¼ by 11¼ in.; paper cover. Published by the Welding Research Council, 29 West 39th Street, New York 18, N. Y. Price $1.00.

* * *

Engineering Thermodynamics, by Newton C. Ebaugh; Second Edition; 398 pages; illustrated; size 6 by 9½ in.; cloth binding. Published by D. Van Nostrand Co., Inc., 250 Fourth Avenue, New York 3, N. Y. Price $5.75.

Obituaries

Clarence C. Rausch

CLARENCE C. RAUSCH, Assistant Vice President, Dearborn Chemical Co. died, April 29, in Houston, Texas, at the age of 57. He had been with Dearborn for 32 years, becoming Assistant Vice President in 1941.

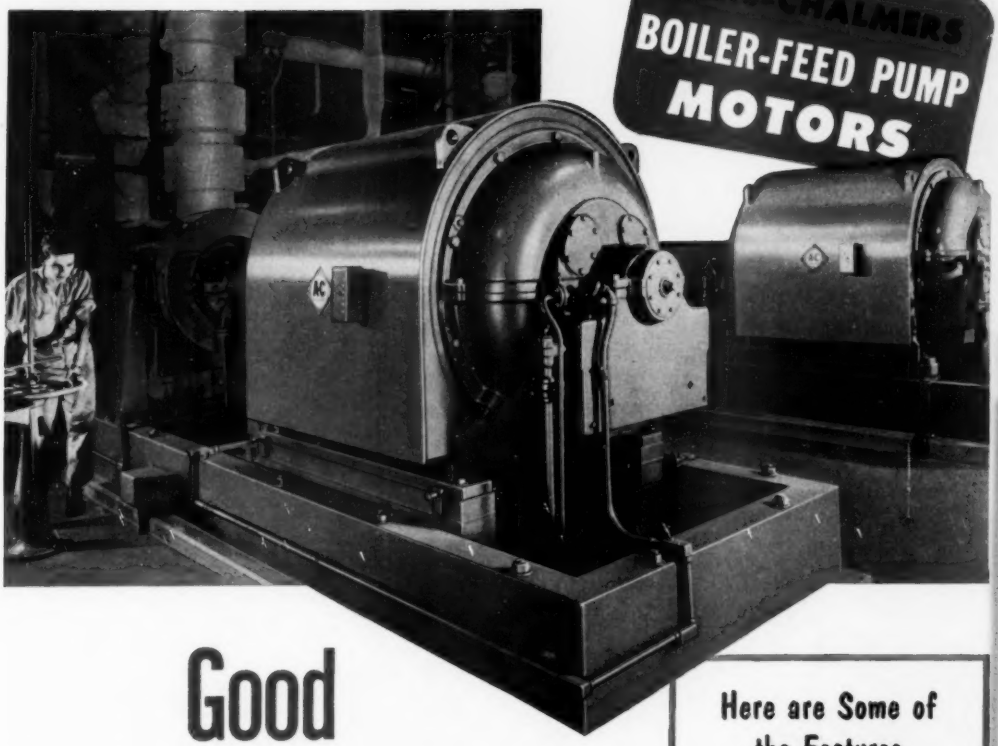
He was a charter member of the company's 25-Year Club and current president. He was a 32nd degree Mason and a member of the American Petroleum Institute, American Gas Association, American Railway Engineering Association, Roadmasters and Maintenance of Way Association of America, American Railway Bridge and Building Association and Allied Railway Supply Association.

Frank L. Harris

FRANK L. HARRIS of the C. H. Wheeler Mfg. Co. died suddenly on June 15th. Mr. Harris was associated with the Wheeler Co. for over 25 years and was employed as Chief Draftsman in the engineering department. During the past several years he took an important part in condenser sales. A member of the St. James Methodist Episcopal Church of Philadelphia and of the Order of Masons, Mr. Harris is survived by his wife and two daughters.

Fred C. Richardson

FRED C. RICHARDSON, mechanical engineer with Westcott & Mapes, Inc., of New Haven, Conn., since 1924, died April 5, at the age of 65. He was born in Peterborough, Ontario, and attended the Peterborough Collegiate Institute and Union College. He was a generator designer with the General Electric Co. from 1907 to 1916 and power engineer with Winchester Repeating Arms Company from 1916 to 1924. He had served as project engineer on many important industrial and central-station steam power plants, including the English and Steel Point Stations of The United Illuminating Co. He was a member of the ASME.



Good Engineering Counts

—ESPECIALLY WITH 3500 HP AT STAKE

THESE 3500-HP, 3582-RPM MOTORS are driving boiler-feed pumps in a midwestern power plant. They were purchased only after a thorough check of Allis-Chalmers two-pole cage motor design details. And their operating reliability has proved that A-C engineering can meet the requirements of the largest boiler-feed pump drives in the power industry. A-3806

GET THE INSIDE STORY — For more information about large two-pole motors, ask your A-C representative for Bulletin 05B7550. Smaller cage motors are described in Bulletin 51B7693. Allis-Chalmers, Milwaukee 1, Wis.

Here are Some of the Features

- Separate steel balancing rings to provide dynamic balancing without weakening the end rings.
- *Dew-drop* bars that give better performance and stay tight in the rotor core slots.
- Forged end rings, drilled to receive the cage bars.
- Oxygen-free copper or deoxidized copper-base alloy bars and end rings to prevent embrittlement from silver-brazing.
- Air distribution arrangement that eliminates hot spots in both the stator and the rotor.
- Ring-oiling adequate for prolonged emergency operation without forced-feed oiling.
- Equalizing air pressure chambers in the bearing housings to positively keep oil out of the motor windings.

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HELPFUL BULLETINS

(*Continued from page 38*)

142 Aluminum Alloys — This 24-pp booklet covers the composition, typical mechanical properties, heat treatments and basic foundry applications of the standard aluminum alloys produced by manufacturer. Each alloy is cross referenced to ASTM, SAE and Alcoa designations of alloys with similar composition and properties. Apex Smelting Co.

OTHER EQUIPMENT

143 Dust Control Brochure — Dust and fume control in many industries is the subject of this comprehensive 24-pp booklet. Tells how cloth-tube type dust collectors are handling complex problems in 33 typical installations. Covers use of these collectors in chemical processing, coal cleaning, sewage disposal. American Wheelabrator & Equipment Corp.

144 Industrial Lubricant — Technical Data Sheet VSA-1 gives 4 pp of information on Valve Seal A, a non-melting silicone lubricant which, besides its stability at extreme temperatures, is highly resistant to oxygen and resistant to many chemicals and gases. Discusses properties of the lubricant, tells its best applications and gives suggestions on its use. A considerable body of information on the chemical resistance of Valve Seal A is given. Dow Corning Corp.

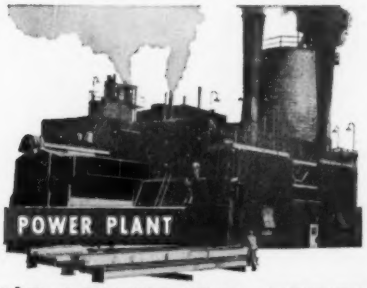
145 Rotary Burners — This newly-published 8-pp booklet describes burners designed for use with any type of oil, as well as for operation in combination with any type of commercially available gas. Gives construction features, explains automatic operation of the burners, details specifications and equipment. Superior Combustion Industries, Inc.

146 Putting Air to Work — Just off the press, Catalog 600 is an excellent, 60-pp reference text on air and the products manufactured to put it to work. For power engineers concerned with heating and ventilating of plant areas; air conditioning installations; means of exhausting fumes, gases and dusts; conveying chips and granular materials; elimination of air-borne dirt — this book is a valuable tool. It's packed with data on selecting and applying equipment. Sturtevant Div., Westinghouse Electric Corp.

147 For Insulation Efficiency — This illustrated bulletin tells advantages of company's Mono-Block, a felted mineral wool insulation, and Powerhouse finishing cement, both engineered for lower installation cost and greater insulation efficiency. Baldwin-Hill Co.

148 Crack-Free Welding — This 10-pp article, "Preheating For Welding," reviews welding procedures found to produce crack-free welding joints under a wide variety of conditions. Five principal reasons for preheating are discussed in full. Tempil Corp.

149 Power Plant Noise Control — Quieting noise with soundproof panels and other installations is subject of this 4-pp bulletin. Company offers four methods of sound control, including treatment of induced and forced draft fans, and sound-proofing of transformers and machinery. Sound absorbing efficiencies are listed. Industrial Sound Control, Inc.



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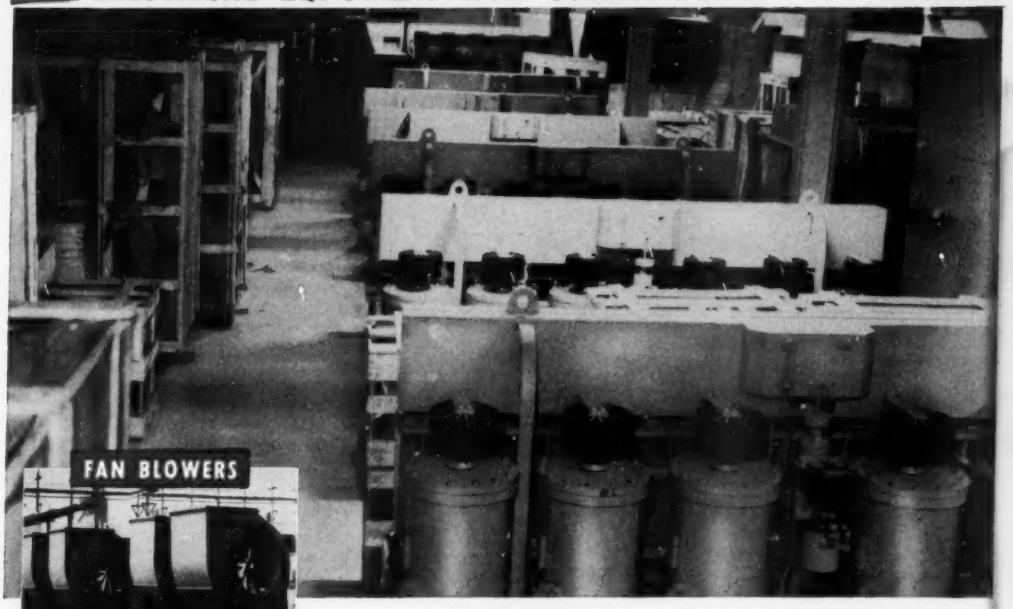

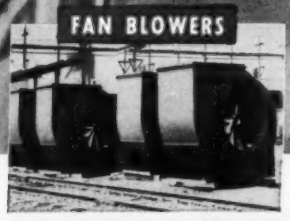

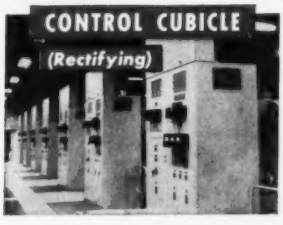

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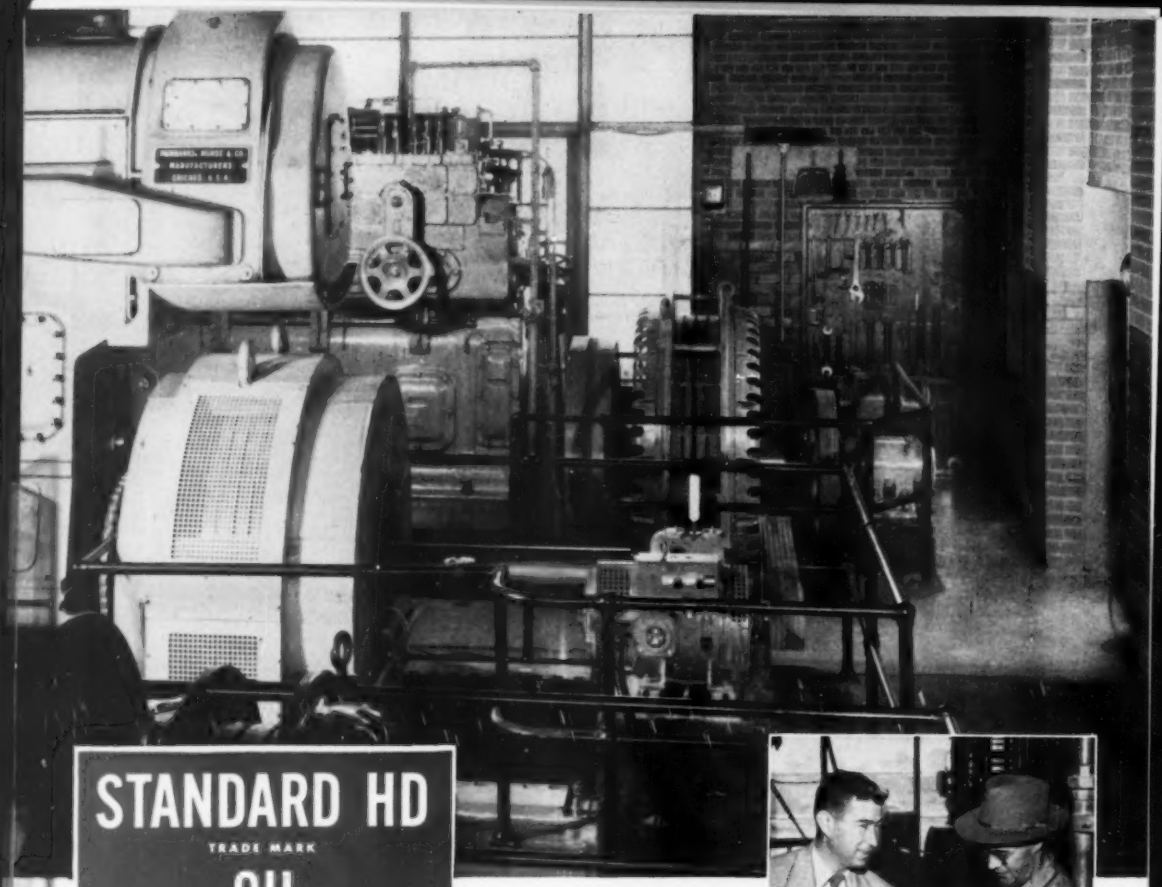

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● The Center Municipal Power Plant of Center, Colorado, had a unique fuel problem. Because of the plant's rather remote location in the Rocky Mountains, the cost of transporting diesel fuel to the plant was extremely high. Resourceful Mr. Vail F. Shumaker, superintendent, worked out a plan for utilizing locally produced crude oil as a fuel. The poor burning quality of this fuel, however, led to trouble. Fuel soot was heavy and deposits formed in the plant's four engines. Rings began sticking.

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Pleased with performance of STANDARD HD oil are J. J. Tyler of Standard Oil (left) and Vail F. Shumaker, Superintendent of Center, Colorado, Municipal Power Plant, who worked closely together to solve a unique fuel-lubrication problem.

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STANDARD *(Indiana)*

Catalog Library

THIS LIST of standard catalogs and bulletins is published to help power engineers maintain a permanent catalog file of data. The items listed, unlike those under Helpful Bulletins, may appear each month except for changes determined by space or by the manufacturers issuing the bulletins. Use the postage-free cards at right for requesting catalogs

INSTRUMENTS, CONTROLS

201 For Centralized Control — Bulletin 109 presents compact Mini-Line equipment suited to control board arrangement which concentrates vital operating information and controls for one or more boilers, turbines or process units before a single operator. Describes vertical-scale indicator units, selector valve, and remote manual relay utilized. Bailey Meter Co.

202 Fundamentals of Instrumentation — Booklet 80-2 offers 126 pp of information on instrumentation in industry. Separate sections are devoted to the fundamentals of measurement and control, measurement of process variables, remote transmission of measurements, automatic controllers, power units and final control elements, control systems and panel-boards. Typical applications are also discussed. Generously illustrated. Available to qualified power engineers; please state title when requesting this book. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

203 For Combining Control Signals — The improved design of company's Ratio Totalizer is described and pictured in color in 8-pp Bulletin 5452. This simplified versatile mechanism is a pneumatically operated control for combining input control pressures and spring forces, and producing an output control pressure based on addition, subtraction, multiplication, division or other functions. Hagan Corp.

204 For Practical Men — This 24-pp pocket-size booklet presents insulation testing in simple language. Packed with maintenance hints, explains electrical insulation, tells how it can be tested and what makes it go bad. It describes the Megger insulation tester, stresses its economy. James G. Biddle Co.

205 Control Equipment — Catalog 001, 30 pp, is on measuring and control equipment for water and sewage works, power and processing industries. Describes venturi tubes and meters, controllers, gages, manometers, pilots. Simplex Valve and Meter Co.

207 Temperature Regulators — Twelve-pp Bulletin T, Catalog 80, describes manufacturer's line of regulators for controlling temperature of liquids and gases, giving their applications, operating characteristics, construction specifications, dimensions. Foster Engineering Co.

COAL, ASH HANDLING

209 Coal Scale — Bulletin 0250, 12 pp, describes a pressure-tight, automatic coal scale, its construction and operation. Shows how beam system, electrical components and linkages are protected from coal dust. Richardson Scale Co.

210 Where Refuse Is Fuel — Presented in 24-pp Bulletin are installations of company's Roto-Grate stokers with medium-size and larger units burning refuse fuels, separately or in combination with coal. Lists many of the refuse fuels handled successfully by this type of spreader stoker. Detroit Stoker Co.

211 Economic Coal Storage — How tractors establish safe, orderly coal handling is told in this 8-pp booklet. Stresses flexibility, low operating costs. Also shows how tractors speed storage reclamation and how a tractor-scraper combination offers plus benefits. Illustrated with action photos; pictures several models. Tractor Div., Allis-Chalmers Mfg. Co.

212 Coal Handling Equipment — Modern equipment for the storage and handling of coal and ash is presented in 24-pp Bulletin 300. Illustrated, covers concrete and tile silos, cylindrical steel tanks, suspended bunkers. Gifford-Wood Co.

213 Spreader Stoker Data — This is a file of three illustrated bulletins on spreader stokers. The first discusses seven reasons for selecting these stokers and describes their design, construction and operation; the second, dumping grates; and the third covers installations. Riley Stoker Corp.

PUMPS, COMPRESSORS

215 Centrifugal Pump Handbooks — Two instruction booklets covering the installation, operation and repair of company's single-stage single-suction and multi-stage centrifugal pumps are available. Suggest inspection procedures and include pages for maintenance records. Also provide tables explaining how to locate trouble and listing causes and cures. Bulletin 08X7813, 24 pp, covers single-stage pumps; Bulletin 08X7780, 48 pp, covers multi-stage pumps. State choice or both. Allis-Chalmers Mfg. Co.

216 Compressor Selection Chart — Based on normal applications handling air with atmospheric intake pressure, this chart simplifies selection of proper size compressor, giving quick comparison between discharge pressure pounds per square inch gage and piston displacement cubic feet per minute. Worthington Corp.

217 Boiler Feed Pump — A barrel-type boiler feed pump for high pressure, high temperature

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service and designed to go on the line quickly without preliminary warm-up, is the subject of 12-pp Bulletin 1535. Fully illustrated text explains automatic operation of hydraulic thrust balance incorporated in this pump. De Laval Steam Turbine Co.

218 Screw Pumps — Bulletin 3204, 18 pp, describes and illustrates Warren-Quimby screw type rotary pumps. Provides sectional and exterior views, installation pictures, dimensions, engineering and selection data. Warren Steam Pump Co., Inc.

219 Centrifugal Pumps — Twelve-pp Bulletin 715-1 presents manufacturer's support-head type centrifugal pumps, describing and illustrating construction details, and providing performance data, specifications and dimensions. These are single stage, ball bearing, enclosed impeller pumps for direct or belt drive. Goulds Pumps, Inc.

220 Rotary Compressors — Bulletin C-6 on rotary compressors. Fully illustrated, provides sketches of intake regulator, and bearing and ring assemblies, also photos of installations. Explains operation. Fuller Co.

BOILERS AND AUXILIARIES

221 Shop-Assembled Boiler — Sixteen-pp Bulletin G-76, completely describes and illustrates company's Type FM water-tube integral-furnace boiler, made in standard sizes from 2900 to 28,000 lb of steam per hr, pressure to 250 psi. Savings in erection, installation and moving costs are stressed along with wide range of applications. Capacities, dimensions and weights are given along with efficiency data. The Babcock & Wilcox Co.

222 Steam Boilers — Form SG 128-749 is a 12 pp catalog illustrated with photos of steam boilers for processing and heating, ranging from 15 to 500 hp and 15 to 200 psi. Includes diagrammatic cross-section of four-pass design characteristic of manufacturer's boilers. Cleaver-Brooks Co.

223 Packaged Generators — Bulletin SB-38 presents company's Keystone model. Photos and sketches show complete unit, pressure element and details of its compact design. Gives advantages of two-drum water boiler, three-pass gas travel, automatic gas or oil burner. Erie City Iron Works.

224 Re-Circulation Steam Generator — Here's a 6-pp folder on a controlled re-circulation steam generator, describing its development and uses, such as applications where steam is required in remote locations, where demands are intermittent, load fluctuating. Combustion Engineering-Superheater Inc.

226 Mechanical Draft Fans — Mechanical draft fans for both forced and induced draft service are described in 20-pp Bulletin 163. Illustrated with drawings of typical fan types and photos of installations, includes performance curves showing efficiencies of various types. The Green Fuel Economizer Co., Inc.

WATER CONDITIONING

227 Chlorination for Power Plants — Form RA-2061-C is a 20-pp technical article, "Recent Developments in Chlorination and Equipment for Power Plants." Discusses such subjects as industrial water chlorination, the desliming processes, air pilot chlorinator operation, organic slimes and scales, chlorine ammonia reactions, chlorine residual recording. Wallace & Tiernan Products, Inc.

228 Water Treatment — Bulletin 5000, 24 pp, explains the reasons for boiler water treatment and tells services offered by company in providing formulations for individual plant requirements. Covers pre-treatment, internal treatment, treatment application, blowdown adjustment, test control. Describes equipment. Dearborn Chemical Co.

230 Carryover Prevention — Eight-pp Technical Paper 115 discusses the role of anti-foam agents in the prevention of carryover of boiler water solids with steam. Covers mechanical and chemical influences on carryover, foaming and anti-foam action, types of anti-foam agents. W. H. & L. D. Betz.

231 Boiler Water Manual — Factual information on methods of applying chemicals in treatment of water for boilers is presented in 16-pp Standard Method 122. Discusses pretreatment of raw water, application of chemical feeding to pretreating operations and both constant rate and flow responsive feeding direct to boiler drum and to feed-water system, condensate returns, % Proportioneers, Inc. %

232 Corrosion Treatment — "Corrosion Protection of Steam and Condensate Return Systems" is a folder on amine treatment for boiler and condensate systems. This treatment is described as affording surface protection of the metal as well as raising pH value of condensate. The Bird-Archer Co.

233 One-Minute Water Tests — Rapid, simple and accurate tests for determining water hardness are described in Bulletin 1RE50. Procedures, reagents, and equipment are described. Hall Laboratories, Inc.

234 Steam System Treatment — This bulletin on Coravol for prevention of corrosion, explains theory of corrosion, application of organic amines to steam systems (the Coravol process) and presents case histories of use in different types of plants and industries. Coravol is part of a complete technical service providing special chemical formulas for treatment of water, steam, brine, fuel. Western Chemical Co.

REFRACTORIES, INSULATION

237 Heat Insulation — This 8-pp booklet on hydrous calcium silicate insulation is illustrated with graphs, tables and drawings showing the numerous ways in which this insulation is used in industrial and commercial projects for temperatures up to 1200 F. Lists wide

(*Continued on page 196*)

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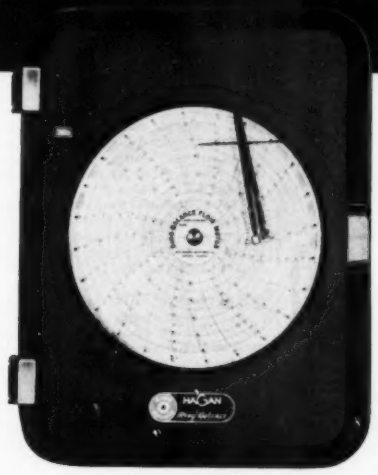

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selection of shapes and sizes to insulate tubes and pipes from ¼ to 72 in. dia and vessels from 72 in. to 60 ft, also flat surfaces. Gives data on physical characteristics, recommended thicknesses. Kaylo Div., Owens-Illinois Glass Co.

238 Heat Insulation Data — This is a 12-pp illustrated engineering and specification manual describing applications for 85 per cent Magnesia heat insulation. Provides data on heat savings per pipe thickness, for heat ranges to 600 F. Includes charts for determining thickness standards for pipe covering, with tables for heat calculations. Mundet Cork Corp.

239 Industrial Insulations — Selection and application information on insulating materials is presented in this 28-pp illustrated catalog. Covers block and blanket insulations, insulating cement, low pressure coverings, felt, other products. Gives specifications, temperature ranges, recommended thicknesses, prices. Baldwin-Hill Co.

VALVES, TRAPS, PIPING AND ACCESSORIES

240 Check Valves — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principle of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details, sizes. The Chapman Valve Mfg. Co.

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241 Gate Valves — Literature is available on cast steel outside-stem-and-yoke gate valves; also on bronze, iron, steel and corrosion-resisting valves in a variety of types. The Wm. Powell Co.

243 To Get at Those Valves — This little folder describes a sprocket rim with chain guide. The rim adjusts to fit all valve wheels. Babbitt Steam Specialty Co.

244 High Pressure Gate Valve — Described in 4-pp Form DH-273 is a forged steel gate valve designed for long service and low cost maintenance. Working pressures, sizes and prices listed. R-P & C Valve Div., American Chain & Cable Co., Inc.

245 Valve Specialties — Included in 90-pp Catalog A-50 is ordering and engineering information on automatic pressure flow and liquid level controls for steam, air, gas, water, oil, other fluids. Sections are devoted to pressure regulators, altitude valve, pump governors and strainers; lever, float and motor operated valves; pilot valves; back pressure, relief and non-return valves, stream trap and air vent; liquid level controllers; solenoid valves. Davis Regulator Co.

246 Safety Valve Engineering Data — How company's safety valve works and its operating advantages are explained in Bulletin 707. Includes dimensions on valve types, tables on superheat correction factor. Manning, Maxwell & Moore, Inc.

248 How to Install, Maintain Traps — Form 1722 is an 8-pp illustrated folder covering use of company's traps. Installation section covers location of traps, hookups, bypasses, use of strainers, other factors to be considered. A chapter on trouble shooting includes discussion of common troubles as well as mysterious and imaginary ones. Maintenance suggestions include testing methods and inspection procedures. Repair parts list included. Armstrong Machine Works.

249 Steam Trap Reference Manual — Bulletin T-1740, 24 pp, tells why and where steam traps should be used; explains desirable trap features. Advantages of company's impulse steam traps are described, their operation illustrated. How to figure trap sizes and how to size condensate return lines are told and capacity and pipe dimension charts and thermodynamic properties of saturated steam included. Also provided are installation and operating suggestions, prices. Yarnall-Waring Co.

250 Steam, Air and Gasoline Traps — Illustrated Catalog 751, 32 pp, provides capacity tables, installation diagrams and a section containing data, charts and formulas for determining proper size trap for specific applications. Covers thermostatic steam traps for pressures to 225 lb, expansion steam traps, weight-operated traps for steam, air and gasoline as well as piston-operated steam traps. W. H. Nicholson & Co.

251 Valves, Fittings and Flanges — Catalog F-9 is a 400-pp, permanently bound reference book on drop forged steel valves, fittings and flanges for practically all piping needs at high and low pressures and temperatures. Provides ordering information on company's complete line, also much helpful engineering and application data: includes a section on

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252 Handbook on Fittings, Flanges — Catalog wf-1950, 68 pp offers working information on seamless carbon steel welding fittings and forged steel flanges. Includes dimensional tolerances, thread standards and threading practice; service pressure ratings, physical and chemical requirements. Grinnell Co., Inc.

254 Piping Pointers — This is company's highly popular 36-pp manual covering fundamentals of sound piping practices. Discusses various types of valve designs and how each should be used. Pictures and names more than 80 fittings and contains illustrated how-to-do-it features. Includes 8 pp valve selection guide. Crane Co.

256 Duplex Strainer — This literature describes company's Duplex strainer with single handwheel control. Shows how it is designed with only one stuffing box and can be cleaned under full flow. R. S. Products Corp.

253 Flanges for Severe Service — This 4-pp bulletin describes a flange specially developed for services involving severe abrasion and corrosives, and for suction and discharge service. Goodall Rubber Co.

255 Design Properties of Pipe — This 12-pp booklet consists of tables listing pipe sizes and wall thicknesses currently established as standard, plus dimensional properties of commercially available sizes of steel pipe. Tube Turns, Inc.

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FUEL OILS, LUBRICANTS

258 Cooperative Technical Consultation Service — This informative 24-pp booklet presents company's periodic consultation service aimed at the most efficient use of petroleum products. Covers services available in the solution of lubrication problems, metalworking operations, processing, fuel oils, dust control. Gulf Oil Corp., Gulf Refining Co.

259 Lithium Soap Greases — Twelve-pp Booklet AD3084, on manufacturer's Stanolith greases, explains how they withstand both high temperatures and wet operating conditions. Discusses two grades — one recommended for central dispensing systems, and a heavier grade for compression cups or pressure gun applications. Standard Oil Co. (Ind.)

260 Air Compressor Lubrication Manual — Valuable information on air compressor maintenance is contained in this 40-pp book. Subjects treated include compressed air, compressors and related equipment, lubricating systems, compressor oils and applications, lubrication requirements, operating hints, oil requirements, storage and care of compressor oils, safety precautions. Cities Service Oil Co.

261 Lubrication of Diesel Engines — An excellent instruction manual, 50-pp Technical Bulletin B-1 (revised) also provides a brief history on diesel engines, an explanation of the fundamentals of design and the common types of diesels and their advantages. Explains combustion process, discusses modern fuel injection systems. Cylinder and bearing lubrication are treated in detail and recommendations given for lubricating oils. Sun Oil Co.

262 Clean Oil for Diesels — A combination purifying and filtering unit utilizing centrifugal force and controlled filtration is the subject of illustrated Bulletin DL-1. Explains operation of the unit, tells advantages. Disucces importance of clean, dry lubricants. The De-Laval Separator Co.

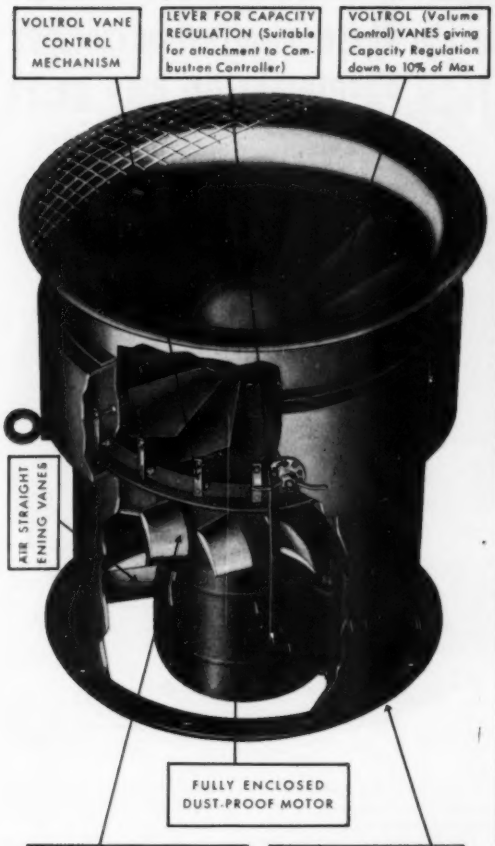
263 Viscosity of Fluids — The larger significance of viscosity is discussed in Nos. 5 and 6, Vol. 36 of Lubrication, a technical publication. In six parts, the first illustrates simplest conception of streamline flow between two surfaces having relative motion. Part II covers streamline flow in capillary and other small tubes. Part III covers turbulent flow in pipes. Part IV discusses effects of temperature and pressure on viscosity, and Part V includes viscosity index. Part VI gives brief reference to nature of plastic flow. The Texas Co.

FUEL BURNERS

265 Gas Burners — Illustrated Bulletin 410–8, 16 pp, furnishes descriptive and technical data on company's gas burners and combination gas and oil burners, giving design details and explaining operation of each type. Coppus Engineering Corp.

266 Steam Atomizing Oil Burners — Sixteen-pp illustrated Bulletin 21 describes steam atomizing oil burners and auxiliary equipment for use with heavy oil or tar in boilers, stills, dryers

WING Type EMD BLOWER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LEVER FOR CAPACITY REGULATION (Suitable for attachment to Combustion Controller)
VOLTROL (Volume Control) VANES giving Capacity Regulation down to 10% of Max
AIR STRAIGHTENING VANES
FULLY ENCLOSED DUST-PROOF MOTOR
WINGFOIL AXIAL FLOW FANWHEEL—Highly Efficient. Mounted directly on Motor Shaft
BLOWER ATTACHED TO WIND BOX OR AIR DUCT AT THIS FLANGE. NO OTHER SUPPORT REQUIRED. Can be arranged for Horizontal or Vertical Mounting

Wing Blowers can be furnished in Single Stage (Type EMD) as shown above, or in Two Stage (Type COM), where the second fan would be mounted on the other end of the motor.

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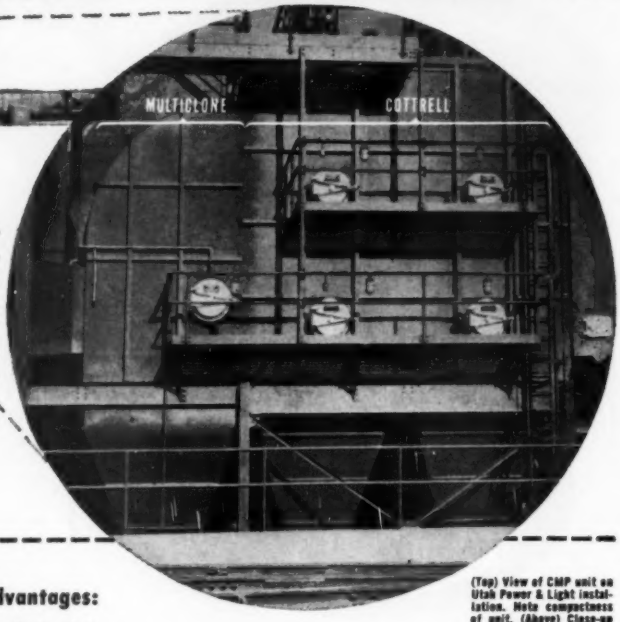


(Top) View of CMP unit on Utah Power & Light installation. Note compactness of unit. (Above) Close-up of same installation.

IF YOU are planning the installation of any type of fly ash recovery equipment—mechanical or electrical—it will pay you to investigate the extra advantages to be gained by installing a CMP Unit designed, engineered and constructed under *one* responsibility by Western Precipitation Corporation—*leaders in both electrical and mechanical recovery fields!*

Combines Mechanical and Electrical Advantages:

A CMP (Combination Multiclone-Cottrell Precipitator) Unit combines—in one compact installation—both mechanical and electrical recovery principles, so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally cleans the gases of the larger and heavier fly ash particles (down to a few microns in diameter)... and the COTTRELL Precipitator then electrically removes the very small particles remaining in the gases. This combination arrangement has important advantages:

1. Using the MULTICLONE for cleaning out the heavier particles permits the bulk of the recovery operation to be performed with relatively low-cost equipment.

2. Using the COTTRELL for final clean-up insures unusually high recovery efficiency—approaching theoretically perfect, if desired—with a high efficiency, compact Precipitator unit.

3. Each type of unit—MULTICLONE and COTTRELL—can be arranged for its most efficient application. MULTICLONES may be connected to each separate boiler, if desired, and their draft requirement cut out when the boiler is down... while a central COTTRELL handles all gases and operates at higher efficiencies, with continued low power cost, when one or more boilers are down.

4. During soot-blowing periods, or while warming up cold boilers, the MULTICLONE efficiency usually increases, preventing overloads of detrimental carbon from reaching the COTTRELL.

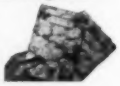
Only Western Precipitation Combines Multiclone and Cottrell "Know-How"—In ONE Organization!

A vital factor in obtaining maximum efficiency and economy in CMP installations is the proper balance of mechanical and electrical recovery equipment to the individual requirements of *each* application. Western Precipitation is unique in that it not only pioneered the commercial application of COTTRELL Electrical Precipitators over 43 years ago, but also has been a leader for many years in the *mechanical* recovery field with its widely-recognized MULTICLONE Collectors.

Result—Western Precipitation has the all-important "know-how" and experience in BOTH fields... knows from first-hand experience how to fit the *right* equipment in the *right* place, to do *your particular* job ... and can provide the complete installation under ONE responsibility and ONE overall guarantee!

Let Our Experienced Engineers study your recovery requirements and make recommendations on the equipment best suited to your operations. A wire, phone call or letter to our nearest office places this unique "Know-How" at your service, without obligation!

Send for descriptive literature!



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and other furnaces, where steam or compressed air is available for atomizing the oil. Discusses steam and oil control valves. National Airoil Burner Co., Inc.

TUBING

267 Double-WalledTubing — Technical Bulletin 1950, 12 pp, presents tubing designed for conditions where single-walled tube can't withstand simultaneous attack from two types of corrosive media. Describes and illustrates construction, illustrating possible metal combinations. Explains tubing's use in ammonia refrigeration, boilers, steam generators. Discusses heat transfer properties, high temperature use. Bridgeport Brass Co.

268 Life Extension for Condenser Tubes — This 32-pp extensively illustrated booklet reports on research into the causes of corrosion and means of combating them, as well as the choice of condenser tube materials. Points out that Admiralty metal, long a standard for power plant condenser tubes, works satisfactorily in most installations, but other alloys may be necessary in some circumstances. Revere Copper and Brass, Inc.

269 Nickel Pipe and Tubes — Bulletin T-17 is a 27-pp technical bulletin on the fabrication and design of nickel and high nickel alloy pipe and tubing, illustrated throughout by drawings and photos. Presents tables on mechanical and physical properties, ASME code requirements, recommended welding procedures. The International Nickel Co., Inc.

TOOLS

271 Pipe Tool Book — This catalog and data book gives information on pipe and bolt machines, power units, ratchet threaders, reamers and cutters, other power and hand tools. Includes "operating guide" section. Fully illustrated. Beaver Pipe Tools.

272 Rotary Tube Cleaners — Bulletin R-105 presents air and water driven rotary tube cleaners and cleaner accessories. Illustrates several models and heads, discussing special features. Roto Div., Elliott Co.

OTHER EQUIPMENT

273 Enclosed Motors — Construction features and details of totally-enclosed, fan-cooled motors with tube-type air-to-air heat exchangers in ratings from 40 hp at 600 rpm through 800 hp at 3600 rpm are described in Bulletin 51B749B. Points out that these motors come in standard and explosion-proof designs. Allis-Chalmers Mfg. Co.

274 Electrical Maintenance Tips — Booklet B-5477, 28 pp, gives a complete outline of preventive electrical maintenance. Discusses general maintenance programs designed to reduce shutdown time and treats in detail the maintenance of power equipment. A suggested schedule of work and cleaning on power equipment is presented in chart form. Essential information on preventive maintenance for turbines, generators, switchboards, motors, controls and other electrical apparatus is provided. Westinghouse Electric Corp. (*See ad on pages 60-61 for information on large induction motors.*)

275 Packings for the Power Plant — Designed as a quick-reference aid, one feature of this compact 6-pp guide is a flow sheet of a rudimentary industrial power plant with each unit keyed to the proper packings and gaskets. These, in

NEW HEAT SAVING EFFICIENCY

- *Longer Life*
- *Custom Molded Precision Pipe Fit*
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Now available in pipe covering and block insulation, Mundet 85% Magnesia permits new heat-saving efficiency. Precision manufacturing on the latest type of automatic equipment insures uniform standards. Extra durability is built into the insulation. It does not "powder", settle or disintegrate. It is unaffected by either steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation. Write for specification information and recommendations. Mundet Cork Corporation, Insulation Division, 7115 Tonnelle Avenue, North Bergen, N. J.

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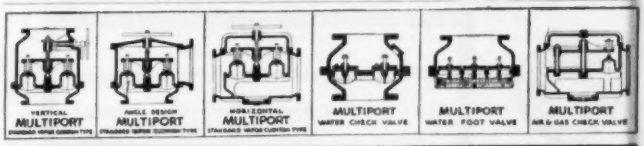

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What Owners say about Cochrane MULTIPORT VALVES

"Twenty-five years of service. No other comment."

"Opened for inspection only once in 17 years."

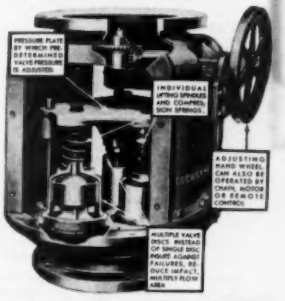
"Opening and closing every 30 seconds with but little interruption for more than 12 years."

"This valve in service about 20 years with no maintenance."

"Savings cannot be computed. Absence of trouble is worth the price."

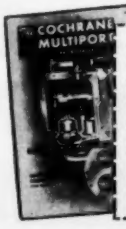
"No maintenance except change of springs for different pressure range after almost 15 years."

"No breakdown, no trouble, no expense."


PRESSURE PLATE BY WHICH PRE-DETERMINED VALVE PRESSURE IS ADJUSTED
INDIVIDUAL LIFTING SPINDLES AND COMPRESSION SPRINGS
ADJUSTING HAND WHEEL CAM ALSO BE OPERATED BY CHAIN, MOTOR OR REMOTE CONTROL
MULTIPLE VALVE DISCS INSTEAD OF SINGLE DISC MINIMIZE DAMAGE AGAINST FAILURES, BY DUCE IMPACT, MULTIPLY FLOW AREA

Over 15,000 Cochrane Multiport Valves in Service

NOT ONE KNOWN FAILURE



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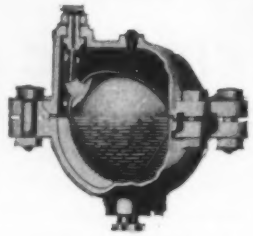
GET RID OF AIR ACCUMULATIONS IN PIPE LINES...



a BIG Trouble Saver that Costs You LITTLE!

When air lodges at high spots in pipe lines, it reduces the effective area of the pipe, creates a friction head, lowers pumping capacity, and may result in serious water hammer!

Simplex Air Release Valves bring you a sure, efficient cure for these difficulties . . . venting air *automatically before it can cause damage.*

The Simplex Air Valve is easily installed . . . positive in action . . . ample in capacity. Standard valves for pressures up to 250 p.s.i. . . . special valves for pressures up to 800 p.s.i. Thousands have been in successful use for over 30 years.

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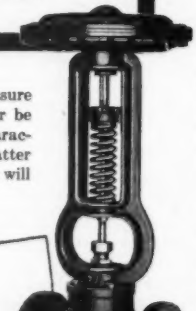
there's a Davis Pressure Regulator
. . . custom-made for your needs!



• To obtain maximum operating efficiency in your pressure regulator installation it is essential that 1) the regulator be the correct size; 2) that it has the proper operating characteristic for the job. The Davis line is complete; no matter how special the application, Davis builds a regulator that will do the job.

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- 18 Different Types
- Sizes to 24 inches
- For Steam, Oil, Gas, Air, Water
- Pressure to 1500 lbs.
- Spring Loaded or Weight Loaded

Davis No. 14 Spring-Loaded, Diaphragm Regulator.

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2508 S. WASHTENAW CHICAGO 8, ILL.

turn, are illustrated with photos and construction information, sizes, etc. Packings and gaskets are grouped according to recommended applications and services. Johns-Manville. *(See ad on page 134.)*

276 Manual on Packings — Containing 84 pp of engineering and ordering information, Catalog 40 covers packings for practically every service. Includes packaging recommendation charts, conversion tables. The Belmont Packing & Rubber Co.

277 Air Preheaters — Illustrated Bulletin A-11610, 8 pp, defines air preheat and explains its benefits in terms of increased efficiency and capacity and flame stability. Provides general description of company's Ljungstrom preheater, discusses its use in boiler plants. The Air Preheater Corp.

278 Plus Protection — Vol. 2, No. 2 of the Magnesium Anode is a 2-pp discussion of the value of supplemental cathodic protection for coated pipelines, using magnesium anodes as the source of current. Dowell, Inc.

279 Transmission Belting — Catalog M-9922, 28 pp, gives design, engineering and performance data on transmission belting. Tables on belt speeds, arc of contact, friction, horsepower correction, and service. United States Rubber Co.

280 Spray Nozzle Systems — Recooling spray nozzle systems for use in plants operating condensers or using large quantities of water for cooling, are covered in 8-pp Bulletin 6A-SP. It details design, application, construction, and operation of spray nozzles, and diagrams typical spray pond arrangements. Sizes, dimensions, capacities, and spray nozzle patterns are included. Schutte and Koerting Co.

281 Turbine Generators — Bulletin H-18, 40 pp, covers turbine-generators of 500 kw and above, pictures nearly 50 turbine-generator installations, both utility and industrial. Brief discussions of generator and exciter cooling methods are included. A reference section offers detailed drawings showing a typical turbine condenser installation arrangement. Elliott Co.

282 Packings and Gaskets — Catalog P-100C, 32 pp, covers 95 most popular packings and gaskets in company's line, furnishing details of construction, service recommendations and size information. Includes charts showing specific recommendations for a wide variety of applications. Packing Div., Raybestos-Manhattan, Inc.

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High Pressure Rubber Gaskets
ALL SIZES TO FIT YOUR WATER GAGES

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GIVES PRECISE FEED AND LEVEL CONTROL

at PLANT YATES *of* GEORGIA POWER COMPANY

Remarkably close feed-flow and water-level control is being demonstrated daily by the COPES Balanced Flow Control at Plant Yates of Georgia Power Company, Newnan, Georgia. Units 1 and 2 went into service late in 1950.

Each unit includes a 3-drum, dry-bottom, radiant-type Combustion Engineering-Superheater boiler designed for a maximum continuous rating of 975,000 pounds per hour. Loads have been carried as high as 1,050,000—as low as 250,000—pounds per hour.

The COPES Control, applied through the hydraulic couplings of the feed pumps, matches feed flow almost perfectly to steam flow, and stabilizes water level within plus-or-minus one inch. Independent of meters and other controls, it can remain on full-automatic when they must be out of service for any reason. Duplicating COPES Control is on order for Unit 3, scheduled to start operation next winter. For complete data on COPES Balanced Flow at this utility write for Bulletin No. 489.

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CONTINENTAL FOUNDRY & MACHINE COMPANY
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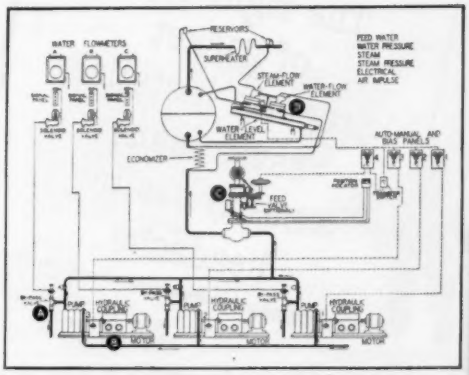


Schematic shows COPES Balanced Flow Control installed for each boiler at Plant Yates. Responsive to three influences—steam flow, feed flow and water level—COPES applies air impulses to position individual controller for the hydraulic coupling of each motor driven pump. Two pumps are normally paralleled, with third on standby, but any pump can be cut in or out by pushing the button to start or stop its motor.

Feed valve is normally wide open, but can be cut into automatic service at any time.

COPES Minimum Flow Control protects the pumps against overheating on light loads.

Headquarters for **Feed Water Regulators • Pump Governors • Differential Valves • Level Controls • Hi-Low Alarms • Reducing Valves • Desuperheaters**

(A) COPES Recirculating Valve used with the Minimum Flow Control System to protect the pumps on light loads.

(B) Air impulses from the COPES Balanced Flow Control actuate this controller on the hydraulic coupling to control the speed of each boiler feed pump.

(C) The COPES Feed Valve, installed in a vertical line, is normally wide open but may quickly be placed on fully-automatic, if and when this is desired.

(D) The COPES Balanced Flow Thermostat has steam-flow and water-level elements mounted rigidly on the frame of the water-level element. It is rugged.

COPES BOILER FEED WATER REGULATION

How to make packings last longer

Tips by Johns-Manville Engineers to help you keep production rolling

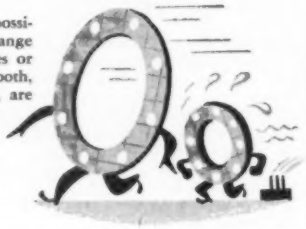
The right type of gasket -properly installed -saves many a costly sealing headache...

Be sure I'm in style.

It's hardly worth while to use inferior quality gasketing for a replacement job, when the right style of a *good* quality gasket material can generally be easily and inexpensively obtained from your near-by Packing Distributor. Therefore, for a packing that will give good service, be sure the style selected is the one recommended for your conditions.

I work better when I'm thin.

Use as thin a gasket as possible for the particular flange condition. When flanges or surfaces are flat and smooth, thin gaskets, as a rule, are better than thicker gaskets. Where surfaces are rough and do not line up perfectly, thicker gaskets usually do a better job.



Don't use oil on me!

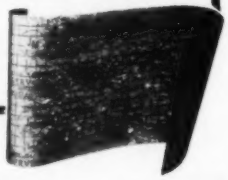
Often gasket materials have rubber in their composition, and oil causes deterioration of rubber. If it is desirable to graphite one or both surfaces of the gasket for easy removal, use a solution of graphite and water, with or without a small amount of glycerine. If the joint is to be permanent, it is better not to treat the gasket at all.

I give better service if you follow these rules, too.

1. Ring-cut gaskets are preferable to full-face gaskets. 2. See that the gasket is properly centered and does not project inside the flanges. 3. Make sure flanges are perfectly clean and true. 4. See that flange surfaces line up and are parallel. 5. Follow up bolts the next day after installing new gaskets.

Why you'll get a better sealing job from J-M SERVICE® SHEET GASKET
Style No. 60

Service Sheet owes its superior performance ability to the care used in its manufacture to produce a consistently uniform product. It is made of selected long fiber asbestos and special heat-resisting compounds, bonded together under heat and pressure. The result is a tough, durable sheet without plies or laminations. It is unusually pliable and resilient and does not dry out in storage. It is effective against superheated steam, air, gas, water, hot oil, ammonia, and many acids and other chemicals.



Your distributor will help, too! Your J-M Packing Distributor can help you take the guesswork out of packing problems. He carries complete stocks of Johns-Manville quality packings and can supply you promptly. For the address of the J-M Packing Distributor nearest you, write Johns-Manville, Box 60, New York 16, N. Y.

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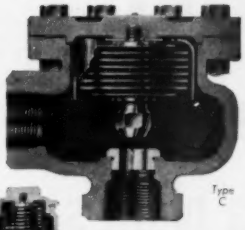
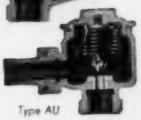
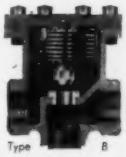
SAVE 4580 LBS. OF STEAM Per CYCLE

A large user of steam on the west coast reports that substitution of Nicholson traps for a mechanical type effected a cyclic saving per dryer of 550 gallons of condensate, or 4580 lbs. of steam. See why leading plants are increasingly adopting Nicholsons for the higher and more even temperatures which result from their advanced features: operate on lowest temperature differential; 2 to 6 times average drainage capacity; maximum air venting.

BULLETIN 152







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Simple! Easy! Best for Use With Pipe Machines, Power Drives or Bench Vises!

Threads ⅛ to 2" Pipe! Finger-tip Control! Nipples Easily Removed! No Wrenches Required!

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WITH POWER DRIVE—CUTS ANY SIZE NIPPLE

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USE WITH ANY MACHINIST'S VISE

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BEAVER PIPE TOOLS

274-300 DANA AVE. • WARREN, OHIO

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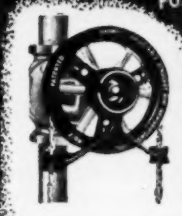
VALVE CONTROL AT LOWEST COST!



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Range of 10 ADJUSTABLE sizes fits all valve wheels, with rising or non-rising stems, from 2 to 30 inches diameter.

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BABBITT STEAM SPECIALTY CO.

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INCONEL...

the heat-resisting alloy for a plant's severest hot spots

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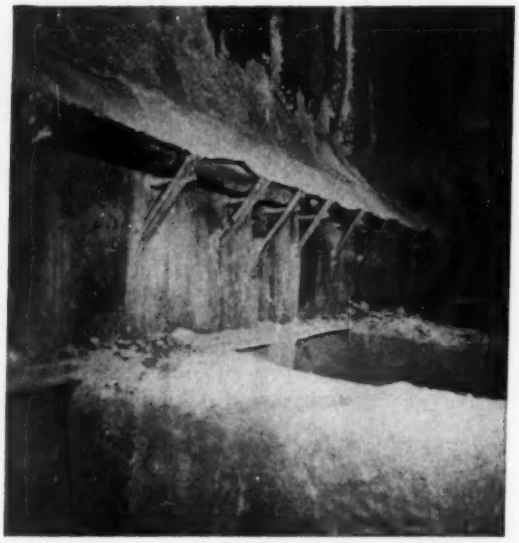

This "water-back" is one of two used in boilers at Toledo Edison's Acme Plant. Made of ¼-inch Inconel plate, these devices are used to break up and cool molten slag as it slides down the division wall between fire and tube sections of the boiler. One side of the plate is subjected to the 2200° to 2400° F. radiant heat of the molten slag, while a spray of cooling water plays on the reverse side. Thermal shock and abrasion are so great that only a tough, high-strength, high-temperature material like Inconel can survive for long. Previously used materials lasted only three months. Yet Inconel gave 18 months of service—and they went out only after the water spray headers (shown under Inconel Cap sheet) clogged and shut off the cooling water.

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And remember, Inconel, like other nickel alloys, is on extended delivery because of defense. Therefore, it is important to include your NPA rating and complete end-use information with all orders.

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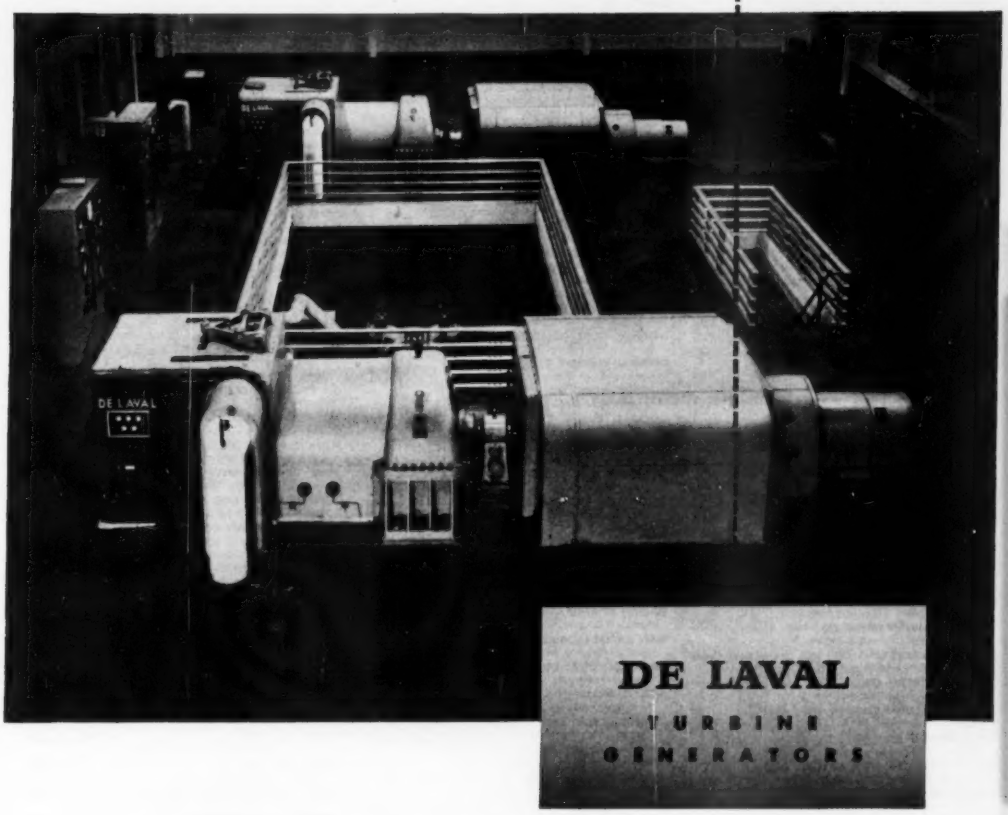
Two thoroughbreds for the blue grass country



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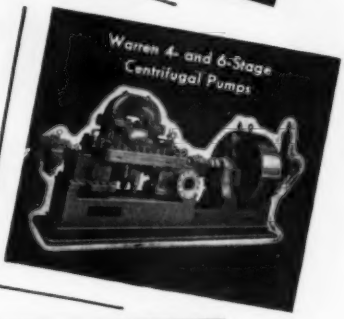

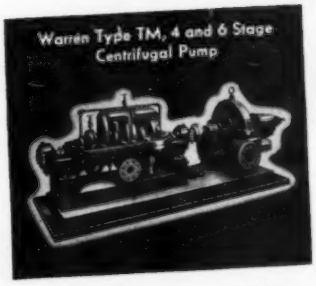

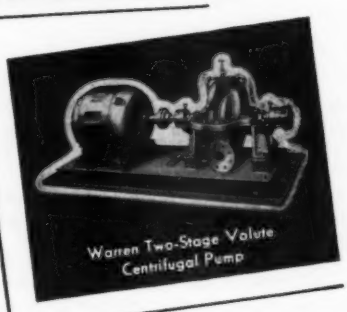

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P-29

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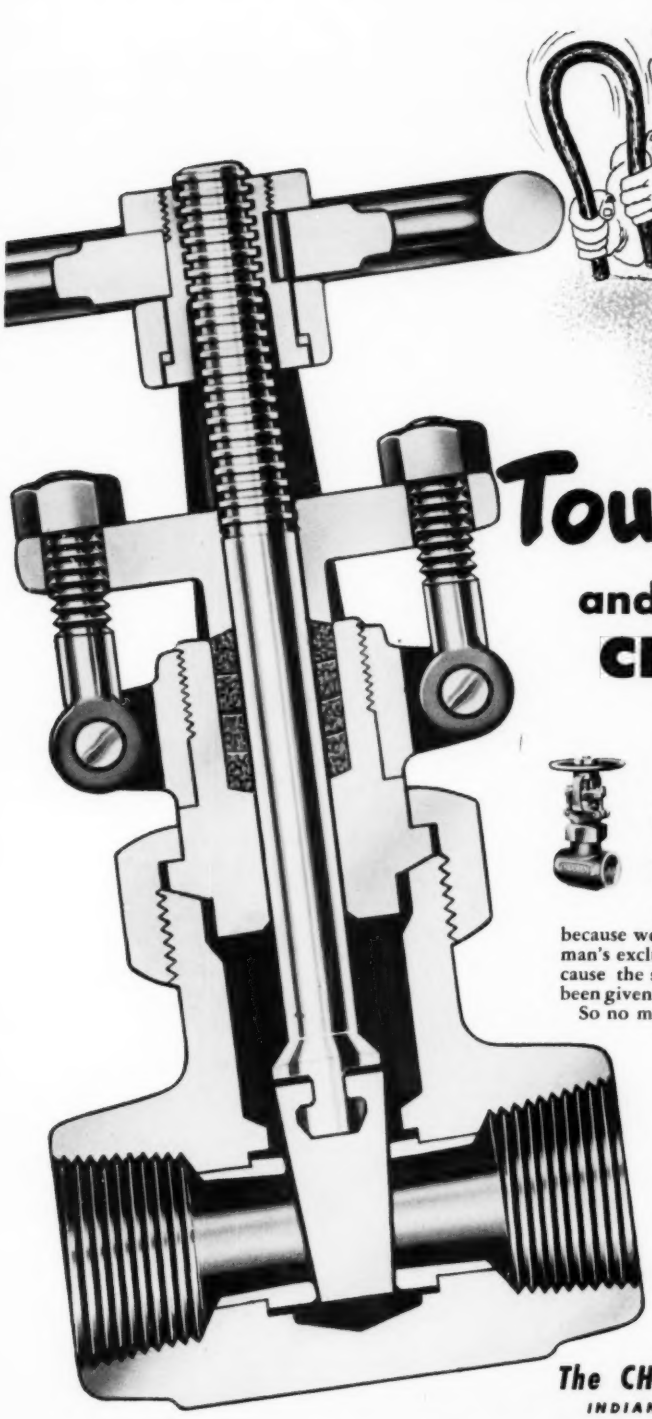

Tough Guy!

and his number is

CHAPMAN

List 960

Tough — that's the word for this small Chapman Gate Valve with the forged steel body and yoke. For no matter what job you put it on, within its remarkable capacity-range, you'll find it *tougher than the toughest conditions!*

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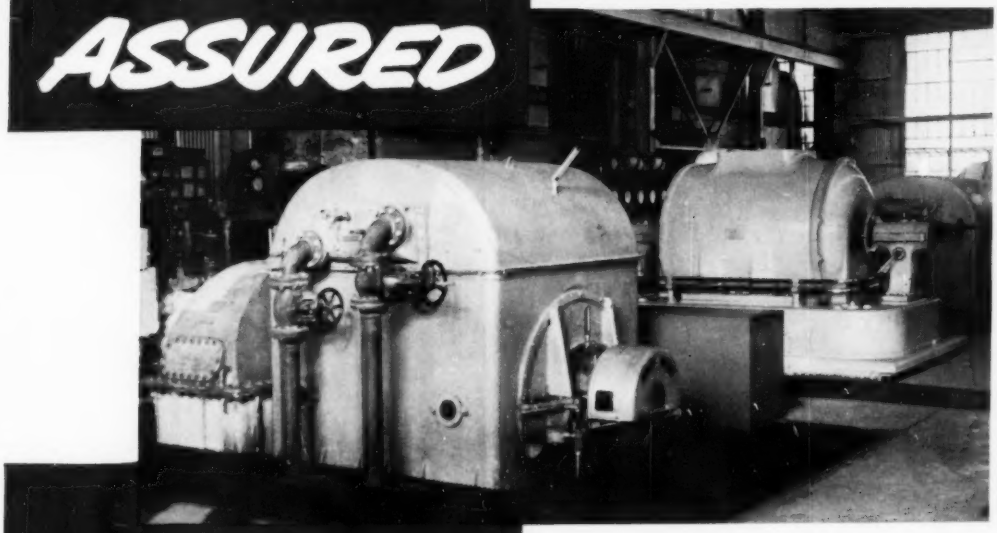

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FOR ALL TURBINES

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